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Cultural Resources Division
Shawnee Mission, Kansas

Prehistory of the Little Blue River Valley, Western Missouri: Archaeological Investigations at Blue Springs Lake

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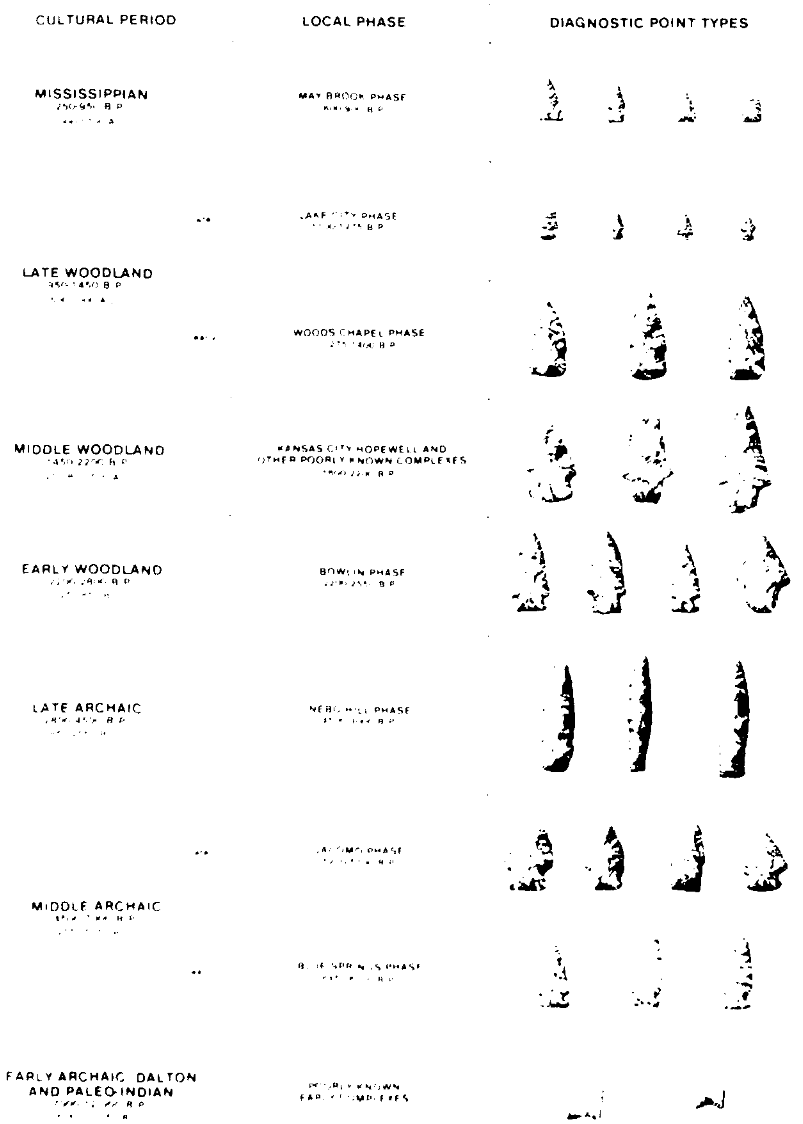

By:
Larry J. Schmits
Editor
Principal Investigator

1989

PREHISTORY OF THE LITTLE BLUE RIVER VALLEY, WESTERN MISSOURI: ARCHAEOLOGICAL INVESTIGATIONS AT BLUE SPRINGS LAKE

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Larry J. Schmits
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This report presents the results of intensive archaeological data recovery investigations conducted at three prehistoric sites in the Blue Springs Lake project. The report discusses the geomorphology and vegetation of the Little Blue River valley, Late Quaternary bioclimatic change in Western Missouri and the results of the archaeological excavations. The information recovered from these sites provides new insight into Middle Archaic, Middle Woodland, Late Woodland, and Mississippian Period May Brook phase adaptive patterns in the Kansas City area.

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ABSTRACT

Blue Springs Lake is located on the East Fork of the Little Blue River in Jackson County, Missouri. As required by various federal mandates archaeological data recovery investigations were conducted at 23JA143, the Cold Clay site (23JA155) and the Black Belly site (23JA238). The result of this work indicates the presence of a deeply buried early Middle Archaic component at 23JA143. This component, designated as the Blue Springs phase, is radiocarbon dated at 6580 to 6660 years B.P. and is characterized by small side-notched projectile points. The component consists of a residential camp probably occupied in the late summer or early fall. Activities were focused primarily on chipped stone tool manufacture and the butchering and processing of deer.

The Cold Clay site is a deeply buried late Middle Archaic occupation with associated radiocarbon dates ranging from 5550-5590 years B.P. Diagnostic artifacts include medium to large-sized corner-notched and expanding stemmed points. This component, referred to as the Jacomo phase, appears to be a residential camp focused primarily on lithic tool manufacture and pigment processing.

The Black Belly site is a stratified Middle Woodland, early Late Woodland and Mississippian occupation. The Middle Woodland component is radiocarbon dated at 1620-1960 years B.P. and is characterized by contracting stemmed Langtry points. It appears to be a seasonally occupied late summer or early fall residential occupation focused on the extraction of white-tailed deer and mast resources. The early Late Woodland component, designated as the Woods Chapel phase, is radiocarbon dated at 1310-1390 years B.P. Diagnostic artifacts include ceramics tempered with fine sand or grit and Steuben projectile points. The Woods Chapel phase component includes habitational structure and storage pits and represents a semi-sedentary occupation or a residential base camp occupied over several seasons. Activities were focused on hunting, hideworking and chipped stone tool manufacture. Subsistence was based on a broad range of faunal resources including elk, deer, raccoon and turkey along with mast resources. The May Brook phase component is radiocarbon dated at 680 years B.P. and is characterized by cordmarked, clay tempered ceramics and small triangular arrow points. Inferred activities include hunting, butchering and scraping. Subsistence was based on deer and herbaceous and mast floral resources.

The data recovered from 23JA143, Cold Clay and Black Belly along with data from other sites investigated in the Little Blue outline a cultural sequence extending from the Paleo-Indian through the Mississippian periods, although detailed information is available from the Middle Archaic through Mississippian. Based on the data from 23JA143 and 23JA155 the Middle Archaic can be subdivided into an early Middle Archaic Blue Springs phase characterized by small side-notched points and a Late Middle Archaic Jacomo phase characterized by larger corner-notched and expanding stemmed points. Late Archaic

manifestations are limited to the Nebo Hill phase typified by lanceolate points, bifacial hoes and fiber-tembered ceramics. Early Woodland sites in the Little Blue valley contain subtriangular corner-notched and contracting stemmed points and are components of a proposed Bowlin phase. The Middle Woodland period is poorly known, but appears to include both Havanna tradition Kansas City Hopewell sites and sites representative of a poorly known local indigeneous Middle Woodland complex, probably related to the earlier Bowlin phase. The Late Woodland period is represented by the early Late Woodland Woods Chapel phase characterized by plain sand tempered ceramics and Steuben points. The late Late Woodland Lake City phase is distinguished by cordmarked grit tempered ceramics and small corner-notched arrow points. Mississippian period occupations are assciated with the Plains Village May Brook phase and are characterized by cordmarked sherd and shell tempered ceramics and small side-notched arrow points.

TABLE OF CONTENTS

I. BACKGROUND AND DESIGN OF THE BLUE SPRINGS LAKE ARCHAEOLOGICAL DATA RECOVERY PROGRAM by Larry J. Schmits....1
Introduction....1
Environmental Setting of the Little Blue River Valley...3
Previous Archaeological Investigations in the Little Blue River Valley....6
Cultural Overview of the Little Blue River Valley....11
Paleo-Indian (12,000 - 8000 B.C.)....11
Dalton (8000 - 7000 B.C.)....11
Early Archaic (7000 - 5000 B.C.)....12
Middle Archaic (5000 - 3000 B.C.)....12
Late Archaic (3000 - 1000 B.C.)....12
Early Woodland (500 B.C. - A.D. 1)....13
Middle Woodland (A.D. 1 - 500)....14
Late Woodland (A.D. 500-900)....15
Mississippian (A.D. 900-1700)....15
Historic (ca. A.D. 1700-Present)....16
Research Goals
Environmental Reconstruction....17
Culture History and Chronology....18
Settlement-Subsistence Patterns....20
Field Methods....23
Laboratory Methods....24
Lithic Analysis....25
Chipped Stone Tool Classification....31
Lithic Manufacturing Debris....32
Summary....34

II. GEOMORPHOLOGY OF THE LITTLE BLUE DRAINAGE by Rolfe D. Mandel....35
Introduction....35
Physiographic Setting....35
Alluvial Soils and Geomorphic Surfaces....36
Alluvial Stratigraphy and Chronology....39
Regional Correlations of Holocene Alluvial Sequences...45

III. VEGETATION IN THE LITTLE BLUE RIVER VALLEY, JACKSON COUNTY, MISSOURI by Ralph E. Brooks....47
Recent Vegetation Surveys - An Historic Account....47
Potential Vegetation....48
Oak-Hickory Forest....48
Floodplain Forest....52
Bluestem Prairie....54
Aquatic Communities....58

IV. LATE QUATERNARY BIOCLIMATIC CHANGE IN WESTERN MISSOURI by Rolfe D. Mandel....59
Summary and Conclusion....65

V. SITE 23JA143 by Larry J. Schmits, Ed Kost and John Neas
Introduction....66
Description of the Investigations....67
Geomorphology and Soil Stratigraphy....70
Radiocarbon Dates....75
Cultural Features....76
Lithic Assemblage....80
Chipped Stone Tools....80
Lithic Manufacturing Debris....90
Unworked Stone....94
Ground Stone Tools....95
Minerals....95
Faunal Remains....97
Butchering and Processing....100
Floral Remains....103
Discussion and Summary....105

VI. THE COLD CLAY SITE (23JA155) by Larry J. Schmits....117
Introduction....117
Description of the Excavations....119
Stratigraphy....123
Radiocarbon Dates....127
Lithic Assemblage....128
Chipped Stone Tools....128
Lithic Manufacturing Debris....142
Ground Stone Tools....146
Minerals....146
Unworked Stone....147
Faunal Remains....147
Floral Remains....147
Discussion and Summary....151

VII. THE BLACK BELLY SITE (23JA238) by Larry J. Schmits....157
Introduction....157
Description of the Excavations....157
Geomorphology and Stratigraphy....164
Radiocarbon Dates....166
Cultural Features and Architectural Remains....167
Ceramics....176
Lithic Assemblage....182
Chipped Stone Tools....182
Lithic Manufacturing Debris....198
Ground Stone Tools....200
Minerals....200
Unworked Stone....200
Faunal Remains....202
Floral Remains....204
Carbonized Seeds....205
Carbonized Nutshells....207
Discussion and Summary....208
The Middle Woodland Component....208
The Late Woodland Component....214
The May Brook Phase Component....217
Summary....218

VIII. PREHISTORIC CHRONOLOGY AND SETTLEMENT-SUBSISTENCE PATTERNS IN THE LITTLE BLUE VALLEY, WESTERN MISSOURI by Larry J. Schmits and Bruce C. Bailey
Introduction..221
Geology and Biotic Resources....................................222
The Cultural Sequence of the Little Blue River Valley..225
Settlement-Subsistence Patterns.................................235
Middle Archaic..235
Late Archaic..237
Early Woodland..240
Middle Woodland...241
Late Woodland...243
May Brook Phase...244
Lithic Resource Utilization.....................................246
Summary...249

REFERENCES..253

APPENDIX I GLOSSARY OF TECHNICAL TERMS

LIST OF FIGURES

Figure 1 Location of the project area in western Missouri......2

Figure 2 Location of Blue Springs and Longview Lakes and well known, previously studied sites in the region.........4

Figure 3 Location of archaeological sites and major federally funded projects in the Little Blue River valley.......7

Figure 4 Lithic terminology used in this study................26

Figure 5 Relationship of soils and landscapes in the Little Blue valley.....................................37

Figure 6 Stratigraphic comparison of 23JA143, 23JA155 and 23JA238..41

Figure 7 Vegetational communities of the Little Blue River valley...49

Figure 8 The coincidence of biotic regions with meteorological regions....................................60

Figure 9 Plan view of the excavation at 23JA143...............68

Figure 10 General views of the 1984 excavations at 23JA143.....71

Figure 11 Profile of the north wall of the excavation at 23JA143..72

Figure 12 Plan view of the excavation and features at 23JA143..77

Figure 13 Projectile points from 23JA143.......................84

Figure 14 Bifacial tools from 23JA143..........................86

Figure 15 Bifacial preforms from 23JA143.......................87

Figure 16 Unifacial and flake scrapers from 23JA143............92

Figure 17 Ground stone tools from 23JA143......................96

Figure 18 Location and plan view of the 1979-1983 excavations at 23JA155..118

Figure 19 General views of the excavations at 23JA155.........121

Figure 20 Profile of the excavation and backhoe trenches at 23JA155...124

Figure 21 Projectile points from 23JA155......................133

Figure 22 Bifacial preforms from 23JA155......................135

Figure 23 Bifacial blanks from 23JA155........................136

Figure 24 Chipped stone tools from 23JA155....................140

Figure 25 Ground stone tools from 23JA155.....................150

Figure 26 Location of the 1979 to 1984 excavations at 23JA238.158

Figure 27 Plan view of the excavations and features at 23JA238...159

Figure 28 General views of the 1983 excavations at 23JA238....161

Figure 29 Features recovered from the Middle Woodland and May Brook phase components at 23JA238...............169

Figure 30 Features recovered from the Late Woodland component at 23JA238..172

Figure 31 Ceramics from 23JA238..............................179

Figure 32 Projectile points from 23JA238......................187

Figure 33 Bifacial tools from 23JA238.........................189

Figure 34 Scrapers from 23JA238...............................194

Figure 35 Cultural sequence, local phases and changes in projectile point styles in the Little Blue valley...229

LIST OF TABLES

Table 1	Temperature and precipitation data recorded during the period 1951-1979 at Kansas City, Missouri....5
Table 2	Radiocarbon dates and geomorphic associations...38
Table 3	Plant species common to the Oak-Hickory Forest in the Little Blue River valley with season of fruit availability indicated................50
Table 4	Plant species common to the Floodplain Forest in the Little Blue River valley with season of fruit availability indicated...................52
Table 5	Plants common to the riverbank and bar areas in the Little Blue River vicinity with season of fruit availability indicated................53
Table 6	Plants common to the upland prairies in the vicinity of the Little Blue River valley with season of fruit availability indicated.........55
Table 7	Plant species common to the lowland prairies in the vicinity of the Little Blue River valley with season of fruit availability indicated.....57
Table 8	Soil profile description for the north wall of the excavation at 23JA143......................74
Table 9	Physical and chemical properties of soils at 23JA143..75
Table 10	Radiocarbon dates from 23JA143..................76
Table 11	Micro-debris recovered from the flotation of features at 23JA143............................78
Table 12	Artifact assemblage from 23JA143................81
Table 13	Descriptive data for projectile points from 23JA143..83
Table 14	Descriptive data for bifacial tools from 23JA143..88
Table 15	Descriptive data for unifacial and marginally retouched tools from 23JA143...................91
Table 16	Summary of use-wear modifications on edge-modified debitage from 23JA143.................93

Table 17	Descriptive data for cores from 23JA143.........94
Table 18	Identified faunal remains from 23JA143..........98
Table 19	Frequency of <u>Odocoileus</u> <u>virginianus</u> elements recovered from 23JA143..........................98
Table 20	Frequency of <u>Odocoileus</u> <u>virginianus</u> cheek teeth sets by age class..........................99
Table 21	Comparison of canid elements from 23JA143 with wolves and dogs..................................101
Table 22	Carbonized floral remains from 23JA143.........104
Table 23	Seasonal availability of floral resources recovered from 23JA143.........................106
Table 24	Use-wear modifications on formal tools from 23JA143..109
Table 25	Recovered materials from activity areas at 23JA143..113
Table 26	Summary of formal tool use-wear by activity area at 23JA143.................................113
Table 27	Summary of edge-modified use-wear by activity area at 23JA143.................................114
Table 28	Micro-debris recovered from flotation samples at 23JA155.......................................122
Table 29	Physical and chemical properties of soils at 23JA155..125
Table 30	Soil profile description at 23JA155............126
Table 31	Radiocarbon dates from 23JA155.................128
Table 32	Artifact assemblage from 23JA155...............129
Table 33	Descriptive data for projectile points from 23JA155..132
Table 34	Descriptive data for bifacial tools from 23JA155..137
Table 35	Descriptive data for unifacial and marginally retouched tools at 23JA155....................141
Table 36	Distribution of use-wear modifications on edge-modified debitage from 23JA155.................143

Table 37 Descriptive data for cores and procured raw material from 23JA155....144

Table 38 Distribution of unworked stone from the block excavations at 23JA155....148

Table 39 Faunal remains from 23JA155....149

Table 40 Use-wear modifications on formal chipped stone tools from 23JA155....154

Table 41 Distribution of artifacts recovered from 23JA238....164

Table 42 Soil description of Backhoe Trench 1 at 23JA238....165

Table 43 Physical and chemical properties of soils from Backhoe Trench 1 at 23JA238....166

Table 44 Radiocarbon dates from 23JA238....167

Table 45 Micro-debris recovered from the flotation of features at 23JA238....168

Table 46 Descriptive data for rim sherds from 23JA238...177

Table 47 Summary of descriptive data for body sherds from 23JA238....180

Table 48 Lithic assemblage from 23JA238....183

Table 49 Descriptive data for projectile points from 23JA238....184

Table 50 Descriptive data for bifacial tools from 23JA238....190

Table 51 Descriptive data for unifacial and marginally retouched tools from 23JA238....196

Table 52 Descriptive data for cores and procured raw material from 23JA238....199

Table 53 Unworked stone from 23JA238....201

Table 54 Distribution of identified faunal remains from 23JA238....203

Table 55 Carbonized seeds and nutshells from the features at 23JA238....206

Table 56	Seasonal availability of floral resources recovered from 23JA238.........................209
Table 57	Use-wear modifications on the chipped stone tool assemblage from 23JA238.......................211
Table 58	Distribution of archaeological components in the Little Blue River valley by terrain type.......226
Table 59	Radiocarbon dated components in the Little Blue River valley..............................227
Table 60	Percentage of chert types and heat treatment for projectile points from sites in the Little Blue valley.............................248

CHAPTER I

BACKGROUND AND DESIGN OF THE BLUE SPRINGS LAKE ARCHAEOLOGICAL DATA RECOVERY PROGRAM

Larry J. Schmits

INTRODUCTION

The U.S. Army Corps of Engineers, Kansas City District is presently constructing Blue Springs Lake on the East Fork of the Little Blue River in Jackson County, Missouri. The location of the project is in the tall grass prairie forest mosaic of the eastern Prairie Plains (Figure 1). This area is in the West Missouri Management Unit as defined by the Preliminary Draft Master Plan for Archaeological Resource Protection in Missouri prepared by the Missouri Department of Natural Resources. Completion and operation of the lake will directly impact and result in the loss of significant archaeological data at three sites 23JA143, the Cold Clay site (23JA155) and the Black Belly site (23JA238), all located within the project area.

Test excavations at the three sites indicated that they contained intact deposits associated with poorly known cultural periods in the Little Blue drainage and the Kansas City area in general. Work at the Cold Clay site (23JA155) indicated the presence of a late Middle Archaic component that predates the Late Archaic Nebo Hill occupation of the area (Schmits and Reust 1980). Work at the Black Belly site (23JA238) indicated the presence of Middle Woodland, Late Woodland and Mississippian period May Brook phase components (Schmits and Reust 1982b). 23JA143 was initially recognized as containing a Middle Woodland component (Peterson and Schmits 1982). Further testing of the site, however, revealed the presence of a deeply buried early Middle Archaic component eroding from a cutbank of the Little Blue River (Schmits et al. 1984).

Since these sites were located within the Blue Springs Lake Archaeological District, they were eligible for the National Register of Historic Places. Stipulations contained in a Memorandum of Agreement (MOA) between the U.S. Army Corps of Engineers, the State of Missouri and the Advisory Council on Historic Preservation provided that archaeological data recovery investigations were to be conducted at these sites if protection and preservation was unfeasible. Since lake construction and operation would have destroyed these sites, the U.S. Army Corps of Engineers, Kansas City District entered into a contract with Environmental Systems Analysis, Inc. (ESA) of Shawnee Mission, Kansas for a data recovery program designed to mitigate the effects of the construction of Blue Springs Lake on these properties. The research

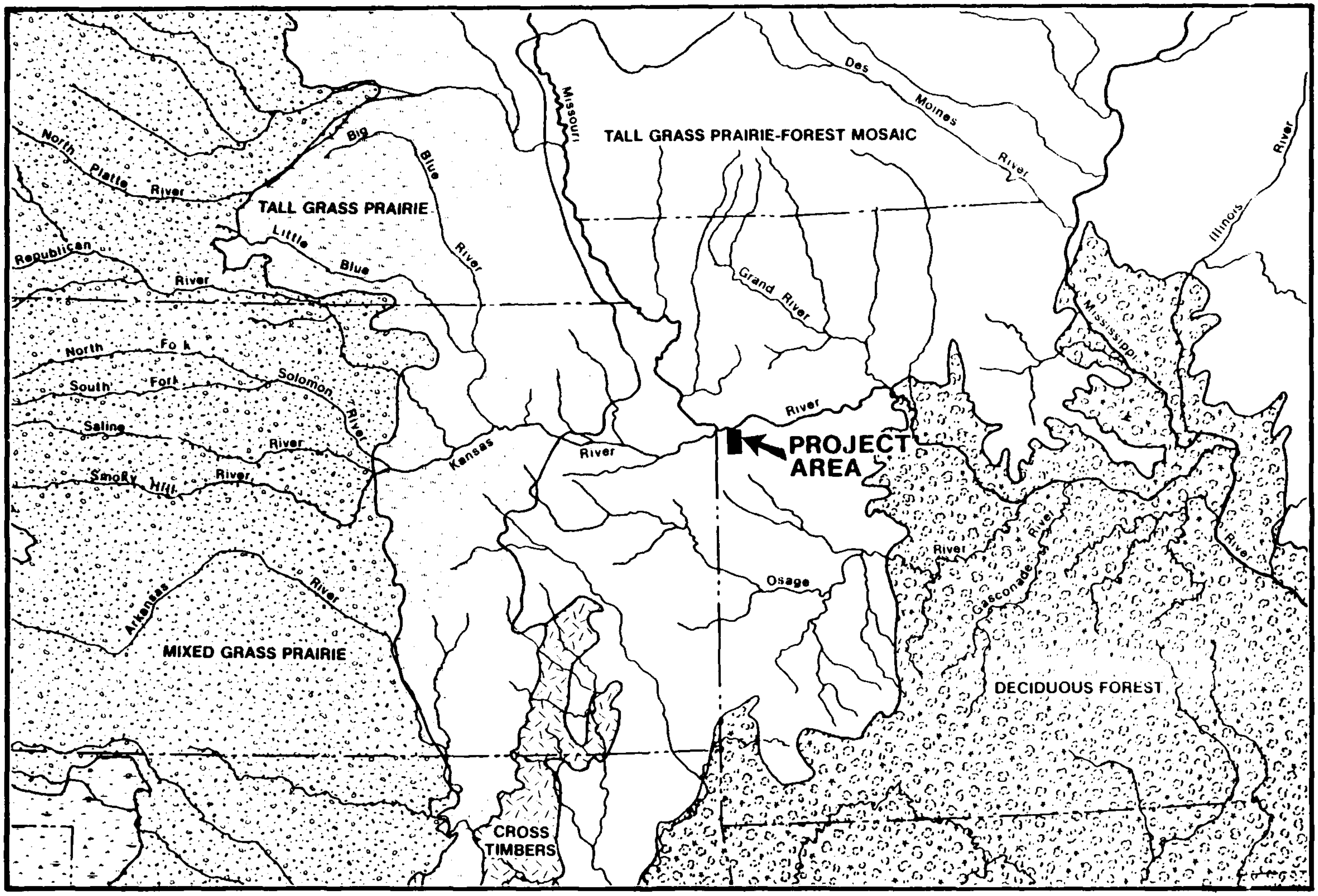


Figure 1. Location of the project area in western Missouri. Vegetational communities after Kuchler (1964).

design for the project developed by ESA was approved by the U.S. Army Corps of Engineers and the Missouri Department of Natural Resources, Historic Preservation Program. The data recovery program was designed in accordance with the guidelines specified in "Treatment of Archaeological Properties: A Handbook" prepared by the Advisory Council on Historic Preservation.

The following report summarizes the program for data recovery and study designed to implement archaeological mitigation of 23JA143, 23JA155 and 23JA238. Chapter II by Rolfe D. Mandel summarizes the geomorphology of the Little Blue valley. Chapter III by Ralph E. Brooks discusses the vegetation of the Little Blue River valley. Chapter IV by Rolfe D. Mandel discusses Late Quaternary bioclimatic change in western Missouri. Chapter V by Larry J. Schmits, Ed Kost and John Neas and discusses the results of the excavation of the buried early Middle Archaic component at 23JA143. Chapter VI by Larry J. Schmits discusses the results of the excavation at the late Middle Archaic component at 23JA155. Chapter VII by Larry J. Schmits summarizes the results of the work at the Black Belly site (23JA238), a multicomponent Middle Woodland, Late Woodland and Mississippian period May Brook phase occupation. The final chapter by Larry J. Schmits and Bruce C. Bailey summarizes the present work and integrates these results along with other recent investigations into an overall summary of prehistoric chronology and settlement-subsistence and lithic procurement patterns as they are presently known for the Little Blue drainage.

ENVIRONMENTAL SETTING OF THE LITTLE BLUE RIVER VALLEY

The Little Blue River is a small tributary valley of the Missouri River incised into Pennsylvanian age shales and limestone (Figure 2). The valley walls are steep and covered with a regolith of weathered, unconsolidated bedrock. The upper margins of the valley walls are marked by outcrops of Bethany Falls limestone, a resistant unit up to three meters in thickness. Weathering under the Bethany Falls limestone often forms overhangs suitable as shelters. The upland bluffs overlooking the Little Blue River consist of heavily dissected ridges separated by ravines and intermittent streams which lead to the Little Blue River. Interfluvial areas are rolling and are generally covered by a thick mantle of Pleistocene loess which thins away from the Missouri River.

The underlying bedrock of the Little Blue River valley contains abundant lithic resources for the manufacture of chipped stone tools. The most commonly available chert occurs in blue-gray or tan varieties within the Winterset limestone, which outcrops just above the Bethany Falls formation. The uplands and hill slopes bordering the Little Blue River contain numerous areas of locally concentrated chert outcropping in the form of weathered regolith. Two other limestones, the Argentine and Westerville, outcrop near the study area and contain chert. The

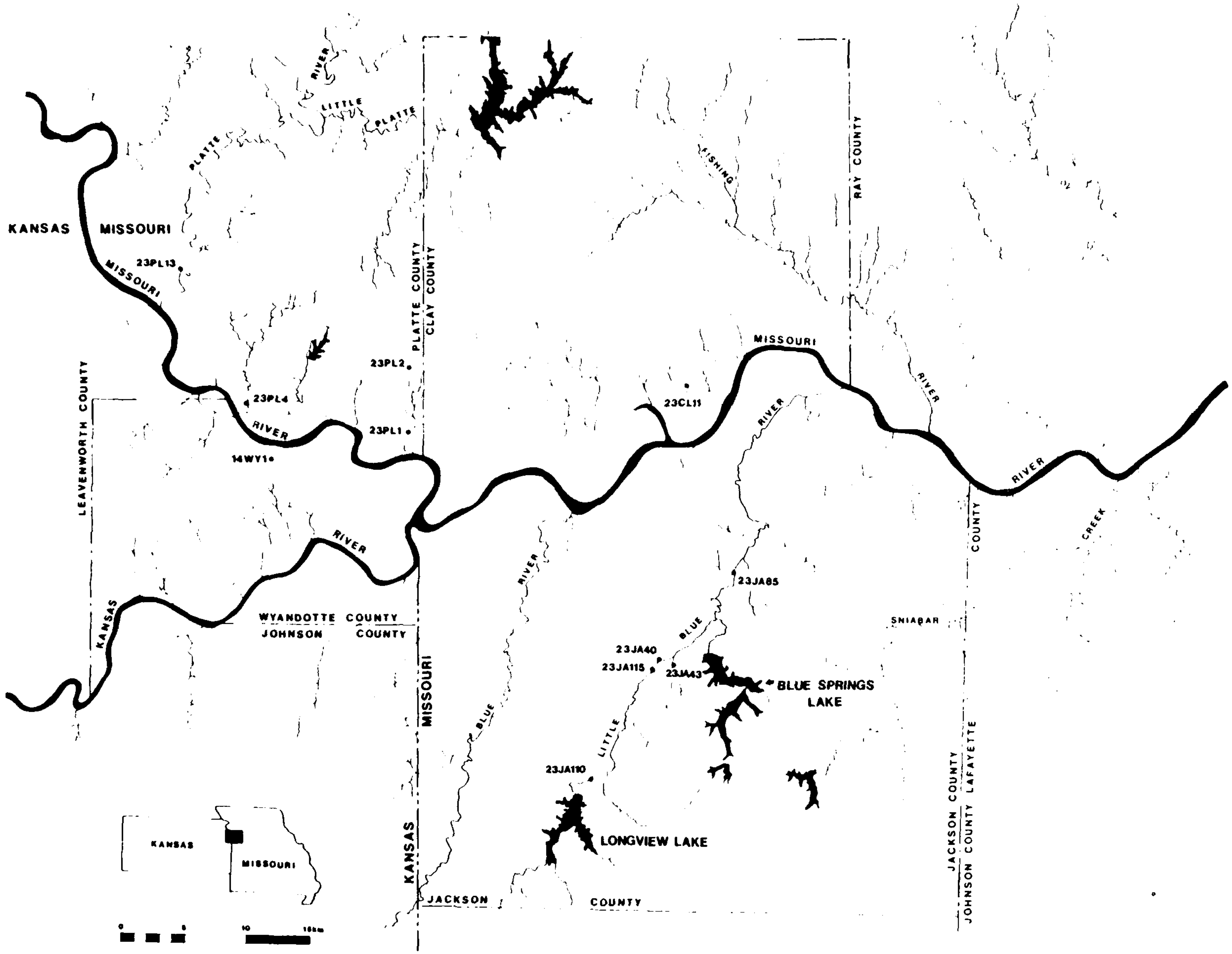


Figure 2. Location of Blue Springs and Longview Lakes and well known, previously studied sites in the region which are mentioned in the text.

nearest chert-bearing deposits of Westerville limestone are to the north, in Clay County. Limited exposures of Argentine chert are present just south of the Longview Lake area just east of Grandview.

The underlying geological structure and the climate are the two major variables maintaining the grassland and deciduous forest biotic communities of the area. Basically, the vegetation of the Little Blue area is transitional between the temperate grasslands to the north and west and the deciduous forest biomes to the southeast. This transitional area is characterized by extensive edge environments (Figure 1).

The study area is within Thornthwaite's (1948) B_1 (humid) climatic zone. This continental-type climate is characterized by extremes in precipitation and temperature. Table 1 provides data on temperature and precipitation for the region as recorded at Kansas City, Missouri, for the period of 1951 to 1979. The mean annual precipitation for the region is approximately 91 cm (Preston 1984:2). About 70 percent of the annual precipitation falls from April through September, with the highest average monthly precipitation occurring in June. The fall and winter are relatively dry seasons. The mean annual temperature for the period from 1951 to 1979 at Kansas City, Missouri is 13.4° C. In winter the average temperature is approximately 0.5° C, and the average daily minimum is -4.4°C. The average temperature for the summer months is 25.6° C, and the average daily maximum is 30.8° C.

Table 1. Temperature and precipitation data recorded during the period 1951-1979 at Kansas City, Missouri.

	TEMPERATURE (C°)			PRECIPITATION (cm)
MONTH	AV. DAILY MAX.	AV. DAILY MIN.	AVERAGE	AVERAGE
January	3.2	-6.8	-1.8	2.9
February	6.3	-3.8	1.3	3.3
March	11.1	0.4	6.0	6.4
April	19.2	7.6	13.3	8.5
May	24.7	13.7	19.3	10.5
June	29.4	19.0	24.3	13.2
July	31.8	21.5	26.6	11.2
August	31.4	20.6	25.6	9.4
September	27.3	15.9	21.6	10.4
October	21.3	9.7	15.5	7.6
November	12.6	1.7	7.4	4.0
December	6.0	-3.3	1.4	3.5
YEARLY AVERAGE	18.8	8.1	13.4	90.9

PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS IN THE LITTLE BLUE RIVER VALLEY

Previous archaeological work in the Kansas City area extends back to the turn of the century, although little work was accomplished along the Little Blue River until the mid-20th Century. Archaeological work along the Little Blue drainage can be divided into two major periods. The first consists of work during the 1950s and 1960s which included the recordation of a large number of sites by local Kansas City avocational archaeologists such as J. Mett Shippee, W. R. "Doc" Wilson, William Philyaw and others. The second stage from 1974 to 1984 marks the intensive involvement of professional archaeologists engaged in the management of cultural resources located in areas impacted by federally funded construction projects. This intensive period of involvement coincided with the passage of various federal mandates in the early 1970s requiring federal agencies to inventory, evaluate and mitigate National Register eligible properties affected by their undertakings.

The first sites in Jackson County were recorded by J. Mett Shippee in the mid-1950s in a survey prior to the construction of Lake Jacomo on the upper reaches of the East Fork of the Little Blue River (Figure 3). A total of nine sites were recorded by Shippee and others in the Lake Jacomo vicinity. In the early 1960s W. R. "Doc" Wilson began private survey work that resulted in the recordation of 12 sites including the Late Archaic Turner-Casey site (23JA35). Later excavation at the site by Wilson, Shippee and others resulted in the location of several hearths. A report identifying the site as a Nebo Hill occupation was published by Wilson (1962). Also in the early 1960s a number of sites were recorded by William Philyaw.

During the summer of 1973 the University of Kansas, funded by the National Park Service, conducted a survey of sites along the Little Blue River to assess the impact of planned channel modification and reservoir construction by the U.S. Army Corps of Engineers (Heffner 1974). A total of 30 sites were located including a large number of those previously reported by Wilson and others. Recommendations were made for testing at 21 sites, extensive excavation at eight sites and no further work at one site.

This initial reconnaisance was followed by a more intensive survey of the proposed Little Blue River channel modification project conducted in 1975 by the University of Kansas for the U.S. Army Corps of Engineers (Reid 1975). The area surveyed included an area 100-200 m in width on both sides of the channel from Blue Mills Road upstream to just east of Grandview, Missouri. The 1975 survey also contained an investigation of the historic architecture of the channel modification corridor (Dryz 1975). While no significant standing architecture was located in the project area, a number of important structures in the immediate vicinity were mentioned.

Following these initial surveys, test excavations were conducted at six sites in the Little Blue River Channel Modification Stage I construction area (Heffner and Martin 1976). Sites 23JA84, 23JA85 and

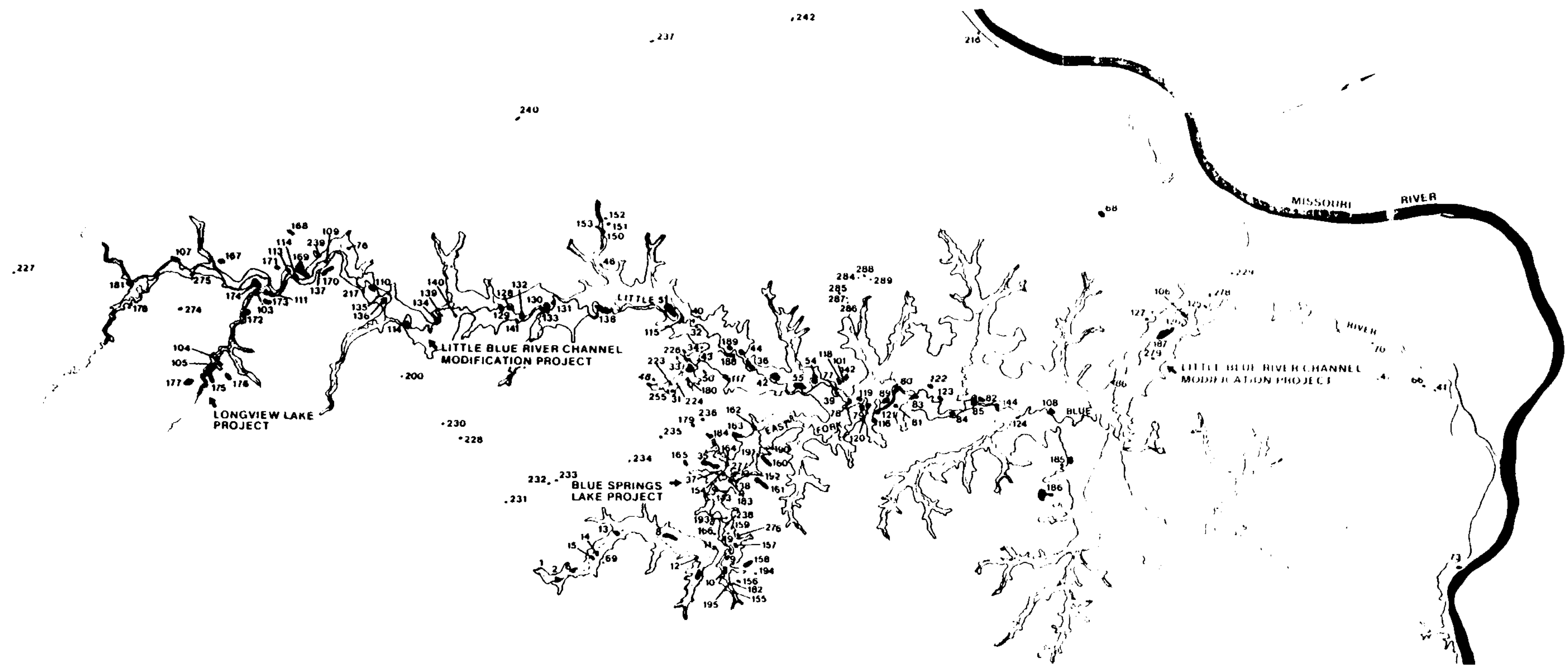


Figure 3. Location of archaeological sites and major federally funded projects in the Little Blue valley.

23JA86 were recommended to be National Register eligible, and while a variety of occupations were suggested for these sites, it appears that a Middle Archaic occupation is primarily evidenced at 23JA86, a Middle Woodland occupation at 23JA84 and a Late Woodland occupation at 23JA85.

In 1976 the University of Kansas completed a research design for the Little Blue River Channel Modification Project for the U.S. Army Corps of Engineers (Brown and Baumler 1976). This document contains a reconstruction of the vegetation of the Little Blue valley based on General Land Office records and a formulation of the vegetational resources available by season. The distribution of sites according to vegetational association and recommendations for a cultural resource mitigation of the Little Blue Channel Modification Project area were discussed.

In 1976 the University of Kansas conducted an archaeological architectural and historical survey of the Blue Springs Lake and Longview Lakes area (Brown 1977). This work also included test excavations at ten sites. The sites tested at Blue Springs in 1975 include 23JA9, 23JA10, 23JA35, 23JA38, 23JA143, 23JA155 and 23JA160. Based on this work Brown recommended further testing at 23JA9, 23JA143, 23JA155 and 23JA160 and salvage excavations at 23JA35 and 23JA238. Sites tested at Longview Lake in 1976 include 23JA109, 23JA137 and 23JA170. Salvage excavation was recommended for sites 23JA109 and 23JA170 and additional testing at 23JA137.

The 1976 survey at the two lake areas resulted in the location of an additional 27 sites in addition to those previously recorded in the two lake areas. Recommendations for the 23 sites at Blue Springs Lake included testing at 13 sites in addition to the four discussed above and no further action at four sites. Recommendations for the 21 sites at Longview Lake included salvage excavations at four sites, testing at 12 sites in addition to 23JA137 and no further action at four sites. The recommendations for salvage excavation at two sites at Longview Lake (23JA112 and 23JA104) were based on surface reconnasiance.

The 1976 work also included preparation of a history of the Blue Springs Lake and Longview Lake areas by Dixon (1977) and an historic architectural survey of the Blue Springs and Longview Lake areas by Lauderdale (1977). The architectural survey isolated a number of structures built before the Civil war. None of these were standing at the time of the survey and Lauderdale surmised that many were destroyed when General Order Number Eleven was issued in 1863. The results of the architectural inventory included a recommendation for preservation of the Rockford School at Longview Lake and also for all of the structures at the Longview Farm, also at Longview Lake. Longview Farm was the county estate of the early 20th century business baron Robert Alexander Long. The 1976 survey and testing program was also supplemented by a soil and geomorphic study (Filer and Sorenson 1977). This work focused mainly on phosphate analysis at some of the sites and coring and grain size analysis of alluvial sediments in the valley.

In 1976 the University of Missouri conducted excavations at the Sohn site, (23JA110) and test excavations at the Coffin site, 23JA200,

(Reeder 1977, 1978). Both of those sites were located within the construction right-of-way of Interstate 470 which bisects the Little Blue River valley between Raytown and Ruskin Heights. The Sohn site was located on a terrace of the Little Blue River and consisted of a multicomponent Late Archaic and Woodland occupation. The Coffin site was located on the upland east of the Little Blue valley and test excavations indicated the presence of a Middle Archaic component.

In 1977 the University of Kansas tested two sites (23JA49 and 23JA159) within the construction right-of-way of the Blue Springs Interceptor located in the Blue Springs Lake Project area (Wright 1980). Work at these two sites was funded by the Environmental Protection Agency and recommendations were made for no further work at 23JA49 and for salvage excavation at 23JA159. The additional work at 23JA159 resulted in the recovery of an Early Woodland component along with associated radiocarbon dates and faunal and floral remains (Wright 1980).

An archaeological and historical survey of the proposed May Brook sewage interceptor line area was conducted by the Kansas City Museum of History and Science in 1976 (Feagins 1976). May Brook is a small tributary of the Little Blue River. Monitoring of construction was recommended and sewerline trenching in the spring of 1979 resulted in the exposure of a previously unknown buried May Brook Phase component at 23JA43. Excavation of the site was conducted by Soil Systems, Inc. in 1979 (Schmits 1980b, 1982b).

In 1979 Soil Systems, Inc., under contract with the U.S. Army Corps of Engineers, began a mitigation program at Blue Springs and Longview Lakes (Schmits 1982). The mitigation program, as designed by the Corps of Engineers, consisted of the excavation of five sites (23JA38, 23JA104, 23JA112, 23JA170 and 23JA35) and testing of 29 sites located in the Blue Springs and Longview Lake areas (Schmits 1982). The sites excavated and tested were based on the recommendations of Brown (1977).

Two of the sites tested in 1979 included 23JA155 and 23JA143. 23JA238, a previously unreported site discovered eroding from a cutbank on the East Fork of the Little Blue River, was also tested. Based on the results of the 1979 testing, mitigative action including preservation was recommended for three sites at Blue Springs Lake including 23JA160, 23JA161 and 23JA182. Further data recovery investigations were recommended for three sites which were to be impacted by construction including 23JA155, 23JA143 and 23JA238. No further work was recommended for eight sites at Blue Springs Lake. The work at Longview Lake resulted in the recommendation for no further work at eleven sites and preservation of 23JA181.

The 1979 testing program at Blue Springs and Longview Lakes also included limited geomorphological work based on backhoe trenching at lowland sites, inspection of cutbanks and reconnaissance of sewerline trenching along the Blue Springs Interceptor, which was being conducted at the same time (Kopsick 1982).

From 1977-1979 the University of Kansas conducted a mitigation

program within the Little Blue River Channel Modification Project for the U.S. Army Corps of Engineers (Brown and Ziegler 1985). This program consisted of testing at seven sites and extensive excavation at three sites. The extensively excavated sites included the Sperry site (23JA85), the Seven Acres site (23JA115) and 23JA40. Based on the results of the testing, 23JA36, 23JA77 and 23JA80 were recommended to be National Register eligible, although no further work appears to have been recommended for these sites. Sites 23JA32 and 23JA55 were found to be severely damaged by agriculture practices and construction.

Finally in 1983 and 1984 additional data recovery was conducted at Cold Clay (23JA155), Black Belly (23JA238) and 23JA143 in the Blue Springs Lake project area by Environmental Systems Analysis, Inc. Buried components had been located at these sites as a result of the 1979 testing by Soil Systems, Inc. The results of this work are discussed in the present volume.

While a substantial amount of archaeological work has been accomplished at the various projects providing most of what we know about the archaeology of the Little Blue valley, in retrospect a number of major omissions appear to have occurred. Perhaps the major shortcoming was the concentration on the location of surface sites and the lack of any comprehensive systematic attempt to locate sites buried in alluvium during the initial surveys at the various projects. No attempts to locate buried sites either by backhoe trenching or inspection of cutbanks were made in either the 1975 Little Blue Channel Modification Survey or the 1976 survey at Blue Springs and Longview Lakes. Nor were any recommendations made for monitoring of construction work that might encounter buried deposits. The 1976 survey work at Longview and Blue Springs Lakes included corings with a Giddings Coring Rig. However, coring at 23JA155 did not locate the buried cultural deposits at this site later discovered by backhoe trenching. In general small cores appear to be of limited value in locating buried sites.

Excavation by the University of Missouri at the Sohn site (Reeder 1978) did include backhoe trenching. While no buried components were located, the soil-geomorphic investigations provided the first attempts to relate the alluvial sequence of the Little Blue valley to known regional alluvial events (Johnson 1978). A survey of the May Brook interceptor sewer did include a recommendation for monitoring and these provisions resulted in the location and excavation of a buried May Brook phase component at 23JA43 (Schmits 1980b, 1982b).

The 1979 testing at Blue Springs and Longview Lake included inspection of cutbanks, backhoe trenching and deep site testing at sites located on alluvial terraces (Schmits 1982). However, this work was limited to the sites scheduled for testing. The results indicated the presence of buried components at the three sites reported on in this study. The potential for the presence of buried early sites is clearly indicated by Kopsick's (1982) and Mandel's (this volume) geomorphological investigations. A considerable number of sites and artifacts have been located during interceptor and lake construction. Perhaps the most noteworthy of these are the human burials discovered in 1983 eroding from a depth of 4 meters below the surface at a diversion

channel at 23JA277 (Baker et al. 1985).

Another serious limitation of much of the cultural resource work along the Little Blue valley has been the absence of work at any historic archaeological sites. While the presence of a number potentially significant historic archaeological sites is indicated by Dixon's (1977) history of the Longview and Blue Springs Lake areas and by Dryz's (1975) survey of the Little Blue River channel modification, no attempt appears to have been made to determine whether archaeological deposits were present at these sites. As a matter of fact no historic sites appear to have been recorded other than the standing structures inventoried by Landerdale (1976) at Longview and Blue Springs Lakes. As a result of these limitations much of what is known about the archaeological of the Little Blue valley is limited to the later segment of the prehistoric cultural sequence.

CULTURAL OVERVIEW OF THE LITTLE BLUE RIVER VALLEY

The cultural sequence for the Kansas City area can be divided into a series of periods characterized by specific technological, subsistence and settlement systems. This sequence, based to a large extent on Chapman (1975, 1980), can be expanded with the data derived from recent cultural resource management studies along the Little Blue drainage. Prior to the present project, relatively minimal information was available for the Paleo-Indian through Middle Archaic periods (12,000 to 3000 B.C.), while more substantial information was available for the Late Archaic through Historic periods (3000 B.C.-present).

Paleo-Indian (12,000-8000 B.C.)

The Paleo-Indian period is poorly understood in many areas of the Midwest, especially in west-central Missouri. Paleo-Indian occupation in the Kansas City area has been documented by surface finds, mainly large lanceolate fluted and unfluted projectile points. Both Chapman (1975) and Shippee (1964) have suggested that Paleo-Indian settlement patterns involved highly mobile nomadism and temporary hunting camps located on upland summits. However, little more is known for this period. The nearest documented Paleo-Indian site is the Shriver site located to the north in Davies County (Regan and Rowlett 1977). Thermoluminescence dates from the site range from 12,855-8690 B.C.

Dalton (8000-7000 B.C.)

This period is viewed as a transitional period involving a shift from an economy focused on big game hunting to a more diversified economy relying on increased use of smaller game and collection of plant resources (Chapman 1975). The Dalton period is best known in the Ozark Highlands of Missouri and is identifiable by the presence of fluted projectile points with distinctive serrated blades. The Dalton period

coincides with the warming early Holocene climate marked by the replacement of spruce-boreal forest with a mixed deciduous forest-prairie environment. Surface finds of Dalton points are common in Missouri, particularly near major rivers, but only three excavated sites (Rodgers Shelter, Graham Cave and Arnold Research Cave) provide good evidence of the period. Dalton points have been found in the Kansas City area but are not as common as they are in the eastern and southern parts of the state.

Early Archaic (7000-5000 B.C.)

In the Kansas City area, the Early Archaic period is less well understood than it is for other parts of Missouri. During this period the environment became similar to that of present-day Missouri. A mixed prairie and deciduous forest environment was probably characteristic of most of the central portions of the state. An increasingly complex cultural pattern developed which involved more intensive exploitation of a wider variety of animals and plants than during previous periods. Caldwell (1958) has referred to this as a movement towards "primary forest efficiency." In the Little Blue valley, the Early Archaic period is represented by a limited number of projectile points from sites 23JA160, 23JA161 and 23JA181 (Peterson and Schmits 1982). These sites are thought to represent short-term occupations focused on the utilization of resources in upland prairie-forest edge environments by groups engaged in a hunting and foraging subsistence strategy.

Middle Archaic (5000-3000 B.C.)

The Middle Archaic period has not been well documented in the Little Blue River valley or in the Kansas City area. Reeder (1977) has suggested that the Coffin site (23JA200), located on the bluffs overlooking the Little Blue River, dates to the Middle Archaic period. Projectile points from the site include medium-sized side-notched forms. Elsewhere in Missouri, this period appears to be a continuation of the Early Archaic (Chapman 1975). Schmits et al. (1982) have suggested that several factors may account for the lack of substantial Middle Archaic occupations along the Little Blue valley. Relatively old sites may have been located in valleys and subsequently buried under alluvial deposits. It was also suggested that scouring by river meanderings prior to stabilization of the T-1 terrace surface may have destroyed earlier sites (Schmits et al. 1982).

Late Archaic (3000-1000 B.C.)

The Late Archaic period in the Little Blue River valley is best represented by sites of the Nebo Hill phase (Reid 1983, Schmits and Wright 1982). Diagnostic Nebo Hill phase artifacts include lanceolate points and fiber tempered ceramics. Radiocarbon dates from Nebo Hill sites range from 4540-2970 years B.P. or 2590-1020 B.C. (Schmits and Wright 1982).

The earliest recognized Nebo Hill sites in the Kansas City area were those located on upland bluffs and ridges north of the Missouri River in Clay and Ray counties (Shippee 1948). Reid (1980b) has suggested that the Nebo Hill settlement system consisted of warm-weather group aggregation at upland sites and cold weather dispersal to sheltered lowland locations. He suggests that the Nebo Hill economy was based on faunal and native floral resources derived from the Missouri River floodplain, the tributary valleys, and the slopes and summits of the adjoining uplands. The upland warm weather phase is hypothesized to have been focused on the fall nut harvest and deer hunting season.

Three Nebo Hill sites have been excavated in the Little Blue River valley including Turner-Casey (Schmits and Wright 1982), 23JA170 (Jurney 1982c) and Sohn (Reeder 1980). Turner-Casey is a large (13-14 acres) upland site overlooking the East Fork of the Little Blue River. Artifacts from the site include fiber tempered sherds, lanceolate projectile points, heavy-duty bifacial cutting and scraping tools and edge-modified flakes. No faunal remains were recovered from the site and the limited floral remains recovered from a pit indicate the utilization of hickory nuts, walnuts and acorns.

23JA170 is a large upland site overlooking the main stem of the Little Blue River just above Longview Lake (Jurney 1982c). The site covers about four acres. Excavations recovered projectile points, a small number of bifaces along with a large number of retouched and edge-modified flakes and lithic manufacturing debris. No organic faunal or floral remains or charcoal suitable for dating was recovered.

The Sohn site is a lowland site located on the T-1 terrace just north of 23JA170. The Nebo Hill occupation at Sohn extended over less than half an acre. Artifacts from the site include lanceolate points, a number of bifaces along with edge-modified flakes. A single date of 2970±490 years B.P. or 1020±490 B.C. was obtained on the Sohn site (Reeder 1978). No faunal remains were recovered and the only floral remains present consisted of a small sample of hickory nuts.

Early Woodland (500 B.C.-A.D. 1)

As late as the late 1970s, the Late Archaic Nebo Hill complex was considered to be the direct antecedent of the Middle Woodland Kansas City Hopewell complex (Johnson 1979:90). However, recent investigations have documented at least four Early Woodland components in the Little Blue drainage including 23JA36 (Brown and Ziegler 1985), 23JA40 (Brown and Ziegler 1985), 23JA159 (Wright 1980) and 23JA38 (Peterson 1982). All four of these sites are located on the floodplain or terraces of the Little Blue River and have radiocarbon dates ranging from 2300-2455 years B.P.

The Traff site (23JA159) appears to have been occupied with a fairly high degree of intensity. Excavations revealed domestic activities distributed around a large open hearth. Wright (1980) suggests that the site was occupied in the late summer or fall. Although the radiocarbon dates from 23JA36 and 23JA40 fall within the

Early Woodland period, they are not directly associated with diagnostic artifacts at these sites. However, projectile points from the surfaces of these sites are subtriangular corner-notched forms with a minor representation of contracting-stemmed forms and are comparable to those from Traff. Ceramics, represented only at Traff, are sand or grit tempered with possible cordmarked surfaces.

Middle Woodland (A.D. 1-500)

The Middle Woodland period, also often referred to locally as the Kansas City Hopewell period, is the most thoroughly investigated archaeological unit in the Kansas City locality (Wedel 1943, Johnson 1976, Johnson 1979). Most of the Kansas City Hopewell sites are located in Platte and Clay counties north of the Missouri River. The introduction of Hopewellian culture to the area is hypothesized to have resulted from westward migration of Illinois valley populations along the Missouri River trench (Johnson 1979). Johnson's (1976) study of Hopewellian settlement patterns indicates that large occupations are located on tributaries of the Missouri River where smaller streams break from the bluff line to enter the Missouri floodplain. Small ancillary camps were located upstream in tributary valleys. These ancillary camps have a more limited range of artifact types in comparison to the larger villages. Johnson suggests that the ancillary camps were established as a response to population increases and the need to expand hunting and gathering territories.

A second interpretation of Kansas City Hopewell settlement patterns has recently been proposed by Reid (1980a). He suggests that the establishment of large permanent Hopewellian villages near the floodplain was not a response to the subsistence related advantages of that environment. Rather, he suggests that the distribution of large settlements is influenced by social and economic factors involving the manipulation of people and goods through riverine navigation (Reid 1980a).

A number of sites with purported Middle Woodland components have been investigated in the Little Blue River valley. Included are 23JA36 and 23JA115 (Brown and Ziegler 1985), Mouse Creek (Jurney 1982b), 23JA112 (Jurney 1982d) and Sohn (Reeder 1978). Few of these sites have produced radiocarbon dates or organic remains. Projectile point styles from these sites are predominantly expanding-stemmed forms characteristic of the middle Kansas City Hopewell period. Ceramics are plain-surfaced and more typical of late Kansas City Hopewell ceramics. Most of these Middle Woodland sites are small camps located on terraces with no evidence of intensive occupation (Schmits et al. 1982). Specific information regarding Middle Woodland settlement-subsistence patterns, such as duration and season of occupation, is limited, partly as a result of the limited information recovered from these sites.

It appears that Middle Woodland sites along the Little Blue River valley consist of small briefly occupied campsites principally located on the terraces of the Little Blue River. No evidence of Middle Woodland occupation has been found in upland settings. These lowland

sites could represent a variety of settlement types, or may represent late summer and fall extractive camps as Johnson (1976) has suggested. More intensively occupied villages would have to be located outside the drainage, as no intensively occupied permanent villages are known to be present along the Little Blue River. Alternatively, the Middle Woodland sites along the Little Blue may have evolved from earlier local Early Woodland social groups with a considerably less complex social organization and settlement pattern than that associated with the Middle Woodland Kansas City Hopewell complex (Schmits et al. 1982). If this is the case, the dispersed short-term Middle Woodland settlements along the Little Blue River may represent the full range of settlement types associated with this culture.

Late Woodland (A.D. 500-900)

The Late Woodland period is the least understood segment of the Woodland sequence in the Kansas City area. In general, it is marked by the disappearance of the once widely distributed Kansas City Hopewell complex. Johnson (1983) has recently subdivided the Late Woodland period in the Kansas City area into an early Late Woodland period which he views as a continuation of the Kansas City Hopewell complex and a subsequent late Late Woodland period. The earlier period is characterized by sand tempered ceramics and smooth surfaced ceramics, some of which have crenated lips. The later period is characterized by increased frequencies of cordmarked surfaces on ceramics and smaller arrow points.

The major Late Woodland site that has been investigated along the Little Blue River valley is the Sperry site, 23JA85, excavated by Brown (1985b). The site is located on a terrace within a meander loop of the Little Blue River. Features from the site include hearths, postmolds and a trash pit. Diagnostic artifacts include small corner-notched arrow points and several larger dart points. Ceramics include grit and sherd tempered vessels with straight to excurvate rims. The majority of the sherds are smooth surfaced but a substantial number are cordmarked. Radiocarbon dates from the site range from 1145-1255 years B.P. or A.D. 695-805 (Brown 1985b). Faunal and floral remains indicate that the site was occupied during the fall or winter. No tropical cultigens were recovered. The small number of features, thin midden deposit and results of soil phosphate analysis indicate that the site was occupied for a short period of time.

The limited data available along the Little Blue valley precludes statements regarding Late Woodland settlement-subsistence patterns. Apparently, these sites consist of seasonally occupied campsites situated in lowland settings along the Little Blue River.

Mississippian (A.D. 900-1700)

The Mississippian period in the Kansas City area is principally marked by the Steed-Kisker phase sites centered on the Platte River drainage north of the Missouri River (Shippee 1972, O'Brien 1978).

Settlements were located on the tops of bluffs overlooking the Missouri River and its tributaries and on the floodplains of tributary streams. Distinctive artifacts include shell tempered incised and plain ceramics and small triangular arrow points. The economy was principally centered on domesticated cultigens and hunting and gathering.

Despite the considerable amount of work that has been done along the Little Blue River, there is little evidence for the presence of Steed-Kisker sites along this drainage. The principal occupation during the Mississippian period appears to be the May Brook phase defined at the May Brook (Schmits 1980b, 1982b) and Seven Acres sites (Brown 1985a). The May Brook phase is characterized by cordmarked and plain surfaced sherd and shell tempered ceramics and triangular notched and unnotched arrow points. The sites consist of short-term, seasonally occupied campsites located on low-lying floodplain areas of the Little Blue River and its tributaries. Radiocarbon dates range from 615-780 years B.P. (A.D. 1170 to 1335), indicating a chronological position centering in the 13th century A.D. Tool manufacture and extractive tasks such as deer hunting and processing and wild seed procurement were the major activities which took place at these sites. The sites lack evidence of architectural features typical of more permanent settlements.

Only minimal occurrence of tropical cultigens was recovered from the Seven Acres site, and no such evidence was recovered from the May Brook site. The hunter-gatherer settlement-subsistence pattern characteristic of these sites contrasts with what is generally known about the Mississippian period elsewhere in western Missouri. More permanent villages or hamlets with fairly substantial architectural remains and a subsistence pattern involving horticulture would be expected. The available information indicates that May Brook phase subsistence patterns were similar to those postulated for the earlier Middle and Late Woodland periods. Since the May Brook phase sites represent one segment of a broader settlement-subsistence system, Schmits (1982b) has suggested that they represent ancillary extractive camps associated with more permanent settlements located outside the Little Blue drainage.

Historic (ca. A.D. 1700-Present)

At the time of European contact, the Blue Springs project area was part of a hazily defined border between the Kansas Indians to the west and the Osage and Missouri Indians to the east. The valley of the Little Blue was part of the Osage hunting territory, although not the scene of permanent settlement (Chapman 1974; Chapman and Henning 1974). The area was part of the Louisiana Territory. France controlled the territory for most of the 18th century before ceding it to Spain in 1763. Spain retained control for the remainder of the century, then France re-assumed ownership in the early 19th century. In 1803, France sold the entire Louisiana Territory to the United States in the Louisiana Purchase (Houck 1908).

White contact began during the period of European control. Baron de Villiers and E. V. de Bourgment passed through the vicinity in the

late 17th and early 18th centuries (de Villiers 1925; Houck 1908). These early explorers were followed by licensed trappers who operated along the Missouri River and its tributaries in the 18th century (Houck 1908).

The project area was among the lands ceded to the U.S. by the Osage in the Osage-American Treaty of 1808 (Chapman and Henning 1974). By 1825, all of Jackson County which includes the project area, was in the hands of Euroamericans. After Missouri was admitted to the Union in 1820, Jackson County experienced a major population increase. Most of the emmigrants were from the upper southern states of Virginia, Kentucky and Tennessee (Political History of Jackson County 1902; McReynolds 1954). The Little Blue River valley served as a center for Confederate guerrilla activity during the War Between the States. Following the cessation of hostilities in 1865, continued economic and population growth occurred in the Kansas City area.

RESEARCH GOALS

The scope-of-work for archaeological mitigation at 23JA143, 23JA155 and 23JA238 delineated a series of research goals including the reconstruction of paleoenvironments, chronological refinement and archaeological phase definition, explication of local prehistoric cultures, prehistoric resource utilization and the examination of changes in settlement-subsistence patterns and social/cultural complexity. The research goals for the project were initially defined in the research design. At the completion of the field work phase, the research goals for the project were revised to more accurately reflect the actual data recovered from the sites (Schmits et al. 1984). In general, the research goals for the program can be grouped into three major categories: environmental reconstruction, reconstruction of culture history and chronology, and investigation of settlement-subsistence and lithic procurement patterns.

Environmental Reconstruction

Previous environmental work along the Little Blue River has primarily consisted of soil-geomorphic studies (Kopsick 1982, Johnson 1978) and vegetational studies (Jurney 1982a, Brown and Baumler 1976). This work has focused on delineation of the terrace sequence within the Little Blue valley and reconstruction of pre-Euroamerican settlement vegetational distribution based on General Land Office (GLO) records. Little had been accomplished in terms of reconstructing past environments or of defining the actual vegetational communities in the area. Although Schmits (1982a) has summarized much paleoecological information from surrounding areas, the implications of Holocene climatic changes on the biotic communities present in the Little Blue valley have not been examined in detail. The principal evidence for environmental change in the Little Blue valley is the alluvial terrace sequence developed by Kopsick (1982) which delineates two major alluvial

terrace fills within the valley. The T-1 terrace appears to have developed primarily during the early and mid-Holocene, from before 8000 years B.P. to just before 2000 years B.P. Data from T-0 sediments indicate that this surface was aggrading as late as 700 years B.P., and therefore that incision of the T-0 surface occurred sometime between 700 and 2000 years B.P.

The aggradation of the T-1 terrace in Middle and Late Archaic times, its final stabilization during the Early to Middle Woodland period, and the subsequent downcutting during the latter part of the Woodland period suggests the presence of minor environmental changes during these periods. Similar occurrences have been noted along the Walnut River valley in south central Kansas (Artz 1980), along the Marmaton drainage in southeast Kansas (Schmits et al. 1983) and along the Pomme de Terre drainage in southwest Missouri (Brakenridge 1981). The co-occurrence of similar changes in fluvial dynamics over widespread areas of the Midwest, and in different drainage basins, suggests that these changes result from a broad regional phenomenon such as climatic change rather than local tectonics.

An objective of the Blue Springs Lake data recovery program was therefore to characterize Holocene environments in the Little Blue valley and to relate these to the alluvial record. Due to the lack of suitable sites for pollen preservation, this had to be accomplished through inferences from neighboring regions.

Culture History and Chronology

The Archaic period in the Kansas City area is primarily known by the Nebo Hill phase. Shippee (1948, 1964) originally postulated an Early Archaic date for this cultural unit based on typological comparisons with sites in the High Plains. The excavations at the Nebo Hill site (Reid 1980a) produced a date of 3555±65 years B.P. and a second and more recent date of 2970±490 years B.P. was obtained from the Sohn site (Reeder 1980). This date has a large standard deviation and the actual time of occupation could have been earlier. A third date of 4550±115 years B.P. has been obtained from the Turner-Casey site (Schmits and Wright 1982). These three dates span an interval of approximately 1500 years from 3000-4500 B.P. suggesting that the Nebo Hill phase is indeed a Late Archaic cultural manifestation.

The additional work at the Middle Archaic components at 23JA143 and 23JA155 adds for the first time considerable depth to the Archaic cultural sequence in the Little Blue valley and in the Kansas City area. Consequently, one can view Archaic development from the early Middle Archaic, as represented by 23JA143, to the Late Middle Archaic period, as represented at Cold Clay, to the Late Archaic period, as evidenced by the Nebo Hill phase sites. A principal objective of the project was to characterize the Middle to Late Archaic cultural chronology in the Little Blue valley.

As noted above, the Woodland period in the Kansas City area principally has been defined on the basis of the investigations of the

Middle Woodland Kansas City Hopewell sites (Johnson 1976). These sites are characterized by ceramic styles indicating a close cultural relationship with Hopewell or Havana groups to the east in central Missouri and the lower Illinois valley. A number of sites along the Little Blue drainage have been assigned to the Middle Woodland period, although only Sohn (Reeder 1978) and 23JA36 (Brown and Ziegler 1985) have been intensively investigated. Ceramics from the Sohn site are grit tempered, have a smoothed surface finish and flaring rims. Projectile points are subtriangular with expanding stems. Two radiocarbon dates from the site are 1800±235 and 1710±75 years B.P. (A.D.150 and A.D. 240). However, Johnson (1983) has recently questioned the dates from the Sohn site and suggested that the site dates to the Late Woodland period. 23JA36 is also located on a T-1 terrace of the Little Blue River north of the Blue Springs project area. Dates of A.D. 430±170 and A.D. 595±210 place the site within the latter part of the Middle Woodland period.

Most of the sites with putative Middle Woodland components that have been identified along the Little Blue River have been interpreted to be Kansas City Hopewell sites (e.g., Heffner 1974, Brown 1977, Brown 1985c). Presumably, these sites were thought to represent ancillary villages, although this was not explicitly stated in these studies. An alternative interpretation suggested by Schmits et al. (1982) postulates that Middle Woodland sites along the Little Blue River developed from local indigenous Early Woodland populations which appear to be fairly common in the area, rather than representing ancillary Kansas City Hopewell sites resulting from migration into the area from the east. The investigation of the Middle Woodland component at 23JA238 provided an opportunity to further evaluate these two conflicting interpretations regarding the origins of Middle Woodland sites along the Little Blue valley.

Johnson (1983) has suggested that many of the Late Woodland sites in the Kansas City area are extensions of the Kansas City Hopewell complex to a period later than his originally postulated terminal date of A.D. 500. The early Late Woodland component from 23JA238 provides an opportunity to characterize the transition from the Middle Woodland into the Late Woodland period, as well as an opportunity to further characterize this poorly known cultural period.

Ceramics recovered from May Brook phase sites are grog tempered cordmarked wares similar to ceramics from Plains Village Pomona sites to the west (Schmits 1982b). These ceramics suggest a continuity with local Late Woodland populations rather than an intrusion of Mississippian populations into the area from centers to the east as is postulated by O'Brien (1978b) for the Steed-Kisker phase. However, the interpretation of a close relationship between the May Brook phase and more westerly Pomona populations has been based on limited data since only two May Brook phase sites have been intensively studied. Consequently, an objective of the work at the May Brook phase component at 23JA238 was to investigate May Brook phase cultural relationships.

Settlement-Subsistence Patterns

Recent investigations of settlement pattern behavior and site location have emphasized the importance of viewing determinants of site placement in terms of the broad subsistence area commanded from a given point rather than in terms of the distinctive characteristics of the point itself (Bettinger 1980). Jochim's (1976) model holds site location to be the result of combined attraction between social groups and its individual subsistence resources, whereas other models hold locational determinants to vary according to site types (Wood 1978).

Brown and Vierra (1983) have suggested a tripartite settlement typology including extractive camps, residential camps and base camps. In this typology, extractive camps are used by only the productive members of a band for short specific tasks leaving few features, few tool types and a low diversity of plant and animal remains. Residential camps contain a greater breadth in the assemblage, debris and features produced from occupation by the total residential population and as a result are more likely to have generalized activity areas. Base camps leave a broad range of tools, debris and features from the occupation by the total population. Permanent housing can be expected as well as organized disposal of trash and a more complex site layout to facilitate the organization of long-term occupation of the site.

More recently, Emerson et al. (1986) have proposed a slightly different site typology based upon site size, artifact density, functional composition of the artifact assemblage, length and season of occupation and site location. Applying these criteria to data derived from excavations in west central Illinois, Emerson et al. propose four site types: base locales, base camps, residential extractive camps and extractive loci. The primary difference between these two typologies is the addition of the base locale site type, which was made necessary by the sedentary Late Archaic occupations investigated in the American Bottoms (Emerson et al. 1986).

The presence of various site types reflects in part the degree of sedentism or mobility of a particular group. The degree of sedentism is to a large extent related to the subsistence patterns. Binford (1980) has suggested two major logistical strategies employed by hunter-gatherers. The first is referred to as a foraging strategy. Foragers typically do not store foods but gather foods daily. Considerable variability among foragers is present in the size of the mobile groups, as well as in the numbers of residential moves that are made in an annual cycle. A good example of the forager adaptation of the !Kung is provided by Lee (1969). When a !Kung settlement is established, foraging is concentrated on foods within a one-mile radius in the first week, two miles in the second week until a maximum of six miles is reached and the camp is shifted owing to the lack of economy in daily trips longer than twelve miles.

In contrast to foragers, "collectors" supply themselves with specific resources through specially organized task groups (Binford 1980). Collectors are characterized by storage of food for at least part of the year and logistically organized food-procurement parties.

Special task groups may have a residential location and establish a field camp or station from which food procurement operation may be planned and executed. Collectors generate additional site types referred to by Binford as residential bases, field camps, stations and caches. These residential bases would be equivalent to Brown and Vierra's (1983) and Emerson et al.'s (1986) base camps. The field camps would probably correspond to extractive camps or loci, but could easily be confused with their residential camps.

Based primarily on physiographic and meteorological considerations, Reid (1980b, 1983, 1984) has suggested a Late Archaic Nebo Hill settlement system consisting of warm-weather group aggregation at upland sites and cold weather dispersal to sheltered lowland sites. He suggests that the Nebo Hill economy was based on faunal and undomesticated floral resources of the Missouri floodplain, the tributary valleys, and the slopes and summits of the adjoining uplands. The upland warm weather phase is hypothesized to have been focused on the fall nut harvest and deer hunting season.

The upland warm weather cycle is seen by Reid (1980b, 1984) as a period of group nucleation in late summer and fall. He suggests that the lowland locational pattern of the smaller Nebo Hill sites probably reflects the need for shelter during cold weather. Reid suggests that increases in foraging travel time caused by decreased winter resource densities could be compensated for by using rivers to logistically expand the size of site support territories.

Reeder (1980, 1981) has proposed a similar Late Archaic Nebo Hill settlement pattern model consisting of warm weather use of the uplands and winter use of the lowlands. He cites exposure to harsh weather, a decrease in the amount of available water and a decline in upland deer populations as factors which would have made it difficult to support large groups of people in the uplands during winter. He suggests that occupation of the lowland areas would be more advantageous during the winter and that the duration of winter occupations may have been shorter with frequent movement. This would have allowed for exploitation of large sections of the lowland environment.

The Reid-Reeder Late Archaic settlement pattern model primarily has been based on comparisons with the upland Nebo Hill sites located north of the Missouri (Reid 1980b) and the lowland Sohn site located along the Little Blue River south of the Blue Springs project area (Reeder 1978). The primary evidence used to support this model is the distribution of resources in the Kansas City area and meteorological variables, although a small amount of supporting empirical evidence such as faunal and floral remains were recovered from the Nebo Hill site. If the Reid-Reeder model is correct, then the large upland Nebo Hill sites along the Little Blue River, such as Turner-Casey (Schmits and Wright 1982) and 23JA170 (Jurney 1982c), should represent warm weather base camps while lowland sites, such as Sohn, represent cold weather encampments or residential loci occupied by smaller dispersed groups.

To date, there has been meager direct substantive data with which to test this model. Limited faunal and floral remains were recovered

from Turner-Casey and 23JA170. The hickory nuts, acorns, walnuts and grapes recovered from the Turner-Casey site (Schmits and Wright 1982) would be principally available from September through October suggesting occupation during this period. However, these remains were recovered from a pit and may have been stored. The only organics recovered from Sohn consisted of a small sample of hickory nuts (Reeder 1978).

Furthermore, the Reid-Reeder model does not easily address possible distinctions between mainstem and tributary site locations. As discussed by Emerson et al. (1986), there is considerable complexity in site types during the Late Archaic in the American Bottoms locale, complexity that, if also present in the Kansas City area, may require modification of the Reid-Reeder model.

The additional data from the buried Middle Archaic components at 23JA143 and Cold Clay (23JA155) provide an opportunity to investigate pre-Nebo Hill Archaic settlement-subsistence patterns in the Little Blue valley. These earlier Archaic settlement-subsistence patterns can then be compared with postulated Late Archaic Nebo Hill patterns.

Woodland settlement-subsistence patterns in the Kansas City area primarily have been based on data collected from Kansas City Hopewell sites. Johnson (1976) interprets Kansas City Hopewell subsistence patterns to be based primarily on hunting and gathering with the important resources being deer, turkey, fish and weed plants such as amaranth and marsh elder. Johnson recognizes two classes of Hopewell sites: large villages (2-15 acres in extent) situated where tributary streams enter the floodplain of the Missouri River, and small campsites (less than 2 acres in size) spread up the tributary streams near their headwaters.

Johnson (1976) suggests that through time, populations in these villages increased to the point where resources were no longer adequate for their support. The establishment of ancillary hunting and gathering camps at varying distances from the village and up the tributary stream valleys was seen as one mechanism to cope with population pressure. A second mechanism was fission and establishment of new village camps and hunting and gathering territories to the north. Johnson (1976) suggests that the ancillary camps had a special functional relationship to the village, primarily serving as hunting and gathering camps designed to procure resources necessary for the maintenance of the village sites. Johnson's (1983) discussion of the Late Woodland period would apparently expand the temporal range of this pattern into the early Late Woodland period.

However, Reid (1980a) discounts the importance of fish or riverine resources in Hopewell settlement-subsistence patterns. He suggests that their riverine location may be better explained in terms of logistics (i.e., boat travel) rather than resource distribution.

Based on Johnson's model, we can hypothesize that Middle Woodland sites located far up on tributary streams, such as 23JA238, would have served an ancillary role to larger villages located at the confluence of the Little Blue and Missouri rivers. Based on this hypothesis, we would

expect a limited set of activities to be represented by the Middle Woodland component at 23JA238 along with evidence suggesting that the site was occupied on a brief, perhaps seasonal basis. On the other hand, if the data from the Middle Woodland component indicates that the site is a base camp, then it is doubtful that Johnson's model is applicable to Middle or Late Woodland populations in the Little Blue valley.

Known May Brook phase occupations along the Little Blue River consist of a small number of sites located on the floodplain or terraces of the Little Blue River and its tributaries (Schmits 1982b). Based on the data recovered from the Seven Acres site and the May Brook site, Schmits (1980b, 1982b) has suggested that May Brook phase sites along the Little Blue valley consist of seasonal short-term extractive sites focused on the abundant resources available during the late summer and fall. Data supporting this interpretation include the absence of permanent architectural features such as structures or storage pits which would be typical of more permanent settlements. The location of the sites on the lowlying floodplain and terraces, which are vulnerable to inundation during the wet season also precludes use on a year round basis.

Based on faunal and floral remains recovered from the Seven Acres and May Brook sites, May Brook phase subsistence patterns appear to be primarily focused on white-tailed deer and the procurement of the seeds of weedy herbaceous plants, such as amaranths, chenopods and purslane, along with mast resources, such as acorns and hickory nuts. The restricted periods of availability of these plant resources supports the interpretation of the Little Blue sites as late summer and fall extractive camps. The absence or low frequency of cultigens from these sites is consistent with the interpretation of these sites as limited use camps.

The information from the two May Brook phase sites investigated to date indicates that the May Brook phase subsistence pattern was very similar to that postulated for the earlier Middle Woodland Kansas City Hopewell complex. Since the May Brook phase sites represent one segment of a broader settlement-subsistence system, it is likely that these extractive camps along the Little Blue are associated with more permanent settlements. Therefore, a principal research goal for the May Brook phase component at 23JA238 was to determine whether this site represents a similar late summer-fall extractive site or a more permanent base camp.

FIELD METHODOLOGY

Data generated during the 1979 test excavations largely dictated the recovery procedures used in the 1983-1984 data recovery investigations. Generally, field work included site preparation followed by excavation of test units, backhoe trenching and block excavations, and in some cases mechanical stripping. Site preparation

involved removal of the vegetational surface cover usually by tractor operated mowers and in the case of buried deposits, the removal of sterile overburden.

Hand excavated test units were placed at all of the sités in order to define the depth and nature of deposits present. In those areas where subsurface deposits or features were located, block excavations were opened up for the intensive data recovery of chipped stone tools, ceramics, carbonized floral remains and materials suitable for radiocarbon dating. Backhoe trenching was employed primarily to determine the presence and location of deeply buried cultural deposits, as well as to expose soil profiles for use in delineating the depositional history of the sites.

Excavation units consisted of one by one m units. Vertical control normally consisted of 10 cm levels. All tools, ceramics and hearthstones were piece plotted to the nearest cm. Level summary forms were completed for each unit and level excavated. Feature data forms were completed for features encountered. Walls of excavation blocks and selected test units were profiled. Features, profiles and various phases of the field work were photographed.

In conjunction with the excavation of test units and block excavations, matrix samples were taken for flotation and waterscreening in the laboratory. These samples were collected systematically by unit and level, as well as opportunistically where features such as hearths and areas of heavy charcoal staining were encountered. Systematically collected matrix samples were 5 liters in volume. The matrix samples were returned to the laboratory for processing. An indoor flotation system, similar to the SMAP machine described by Watson (1976), was used in processing the samples. This permitted separation of the micro-debris into a bouyant, light fraction consisting of charcoal, carbonized nuts and seeds and noncultural debris such as rootlets, etc. The heavier fraction included larger micro-lithic debris, ceramics, bone, unworked stone and nonbouyant charcoal and nutshells. The collection of these samples ensured the recovery of preserved microfaunal and floral remains for use in reconstructing settlement and subsistence patterns for the various components at each site.

In summary, the field methods employed during the investigations were designed to ensure maximal efficient recovery of chipped stone tools, ceramics, features, carbonized floral remains and materials suitable for radiocarbon dating in order to fully realize the significance of each site and its role in prehistoric cultural adaptation in the Little Blue River basin.

LABORATORY METHODS

The assemblages recovered from the sites were initially sorted into raw material categories such as ceramics, chipped stone, ground stone, unworked stone and other classes of debris. Chipped stone tools and

lithic debitage constitute the largest class of artifacts found on the sites. Classification is important in organizing this data set and in providing a body of information from which inferences regarding cultural history and settlement-subsistence and lithic procurement patterns can be made. The primary types of information being sought in the present study include the chronological placement and identification of functional activities that took place at the sites in question. This information is often important in establishing the cultural affiliation of a site and in determining its role in prehistoric settlement-subsistence and lithic procurement patterns. At the same time, it is important that a classificatory scheme be a comprehensive descriptive device in order to fully document the technological variability between assemblages.

Lithic Analysis

With the above objectives in mind, the lithic analytical system developed for the Blue Springs Lake mitigation program has combined elements of many techno-morphological and functional classificatory procedures. A principal objective of the approach was to develop a system which would provide data regarding the use of lithic implements and at the same time permit rapid classification of the assemblages.

The initial procedure was a technological subdivision of the assemblage into categories based on the presence or absence and type of edge retouch present (Chapman 1977). Retouch can be separated into two general categories defined by the length of retouch scars relative to the surface area upon which they are visible. If the scars extend from the perimeter of the edge over one-third or more of the dorsal or ventral surface of the tool, then the retouch is termed facial or invasive retouch (Figure 4a-b). If the retouch scars extend from the edge perimeter over less than one third of either surface, then it is termed marginal retouch (Figure 4c). Facial retouch observable on only one surface of debitage is termed unifacial retouch (Figure 4b). Facial retouch observed on both the ventral and dorsal surfaces of debitage is termed bifacial retouch (Figure 4a). Facial retouch, whether bifacial or unifacial, results in considerable alteration of the morphology of a piece of debitage.

Within the two categories of facially retouched tools, a number of tool classes can be recognized on the basis of morphology (shape), placement of working edge, edge shape and evidence of edge or use-wear. These attributes serve to identify broad tool categories which can then be associated with general prehistoric activities.

A problem often encountered in classification is that many tools indicate multiple functional uses, such as cutting wear on projectile points or knife wear on scrapers. Classification of multifunctional tools can be approached in several ways. On cultural resource management projects such as the present one where collections must be rapidly processed, it is often most efficient to assign the tool to its principal class based on the overall morphology of the tool. In this case, a projectile point with secondary evidence of knife wear would

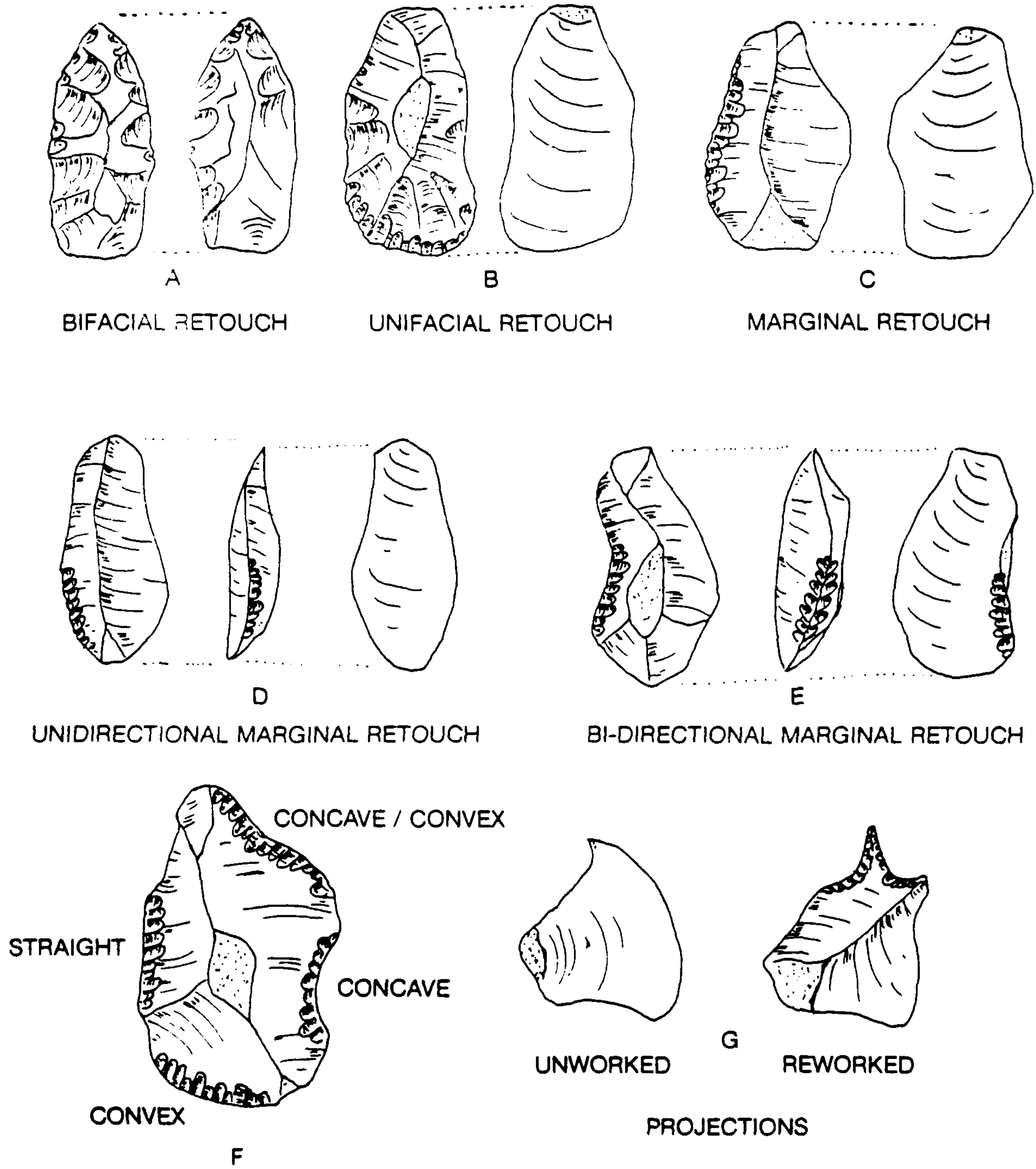


Figure 4. Lithic terminology used in this study. (Modified after Chapman (1977)).

still be classified as a point.

Edge Shape. Many attributes of the edge shape of formal bifacial and unifacial tools are informative about the function of the tool. In general, beveled edge shapes asymmetric to the horizontal plane or maximum projection of the tool are termed planoclinal and can be associated with scraping use while thin symmetric "biclinical edges" can be associated with use as a cutting tool (Isaac 1977).

The plan view edge outline or perimeter of informal utilized or retouched edge modified tools can be classified as straight, convex, concave or as a projection (Figure 4f). A projection is a pointed edge which projects outward from the perimeter of a piece of debitage (Figure 4g). Projections may be simply utilized junctures where two portions of the perimeter meet in an acute angle, or they may be prepared by retouching. Some projections terminate in a pointed tip, while others end in a rounded tip. Utilized projections indicate use as piercing, boring or incising tools.

Wear Patterns. Wear patterns are patterns of microfracture or abrasive wear resulting from force having been applied to some portion of the artifact edge during its use. A number of recent studies (Tringham et al. 1974; Hayden 1979; Keeley 1980) have been able to relate specific edge damage or wear on chipped stone tools to tool function. A major problem encountered in use-wear analysis is separating the edge damage resulting from use from that resulting from manufacture or intentional retouch of the tool edge. The regularity of flaking wear, the relative discreteness or non-discreteness of flake scars and the degree of invasiveness of flake scars are all important in separating retouched edges from use damage.

Flaking wear can be termed regular when the majority of the flake scars are of the same size and shape and are continuous along the tool edge. Irregular flaking scars are of different sizes and shapes and are discontinuous along a tool edge. Regular flaking scars are associated with intentional retouch while irregular flaking scars are generally associated with tool utilization. However, regular flaking scars can also be produced by scraping use (Tringham et al. 1974).

Flaking scars are termed discrete when the flake scars extend from the edge all the way to the termination. Discrete flake scars are generally found only on retouched tools. Flaking resulting from utilization is initiated at a broader point so that scars near the edge are not as well defined or are non discrete. Non-discrete flaking scars can therefore be generally associated with utilization rather than retouch. The relative degree of invasiveness of flake scars also provides evidence as to whether the edge has been intentionally retouched or utilized. To a lesser degree it also indicates tool use on hard materials as opposed to use on soft materials. Chapman (1977) suggests that all use-wear is confined to less than 1 mm from the tool edge. Our experiments and those of Keeley (1980) indicate that use wear can extend beyond 1 mm, but rarely extends over 3 mm. The orientation of flake scars to the tool edge results from the direction of tool use. Transverse motion results in perpendicularly oriented flake scars, while

longitudinal motion yields diagonally oriented flake scars.

The basic unit of analysis in wear pattern studies is an individual edge rather than an entire artifact. In general, three variables including wear type, location of wear and scale or measurement of wear appear to be important in determining the function of tools from edge-wear studies.

The two major classes of edge-wear include flaking wear and abrasive wear (Ahler 1979; Odell 1979; Chapman 1977). Flaking wear includes various fracture types such as snap, feather, hinge, step and crushing. Standard classification of the first four of these fracture types has been proposed Hayden (1979). Snap is defined as half-moon shaped breakage terminating nearly perpendicular to the opposite face. These fractures are common on very low angled edges (Keeley 1980). Feather fracture occurs when a flake terminates in an edge with a minimal margin. A flake which terminates in a smooth, steep, approximately right angle, forms a hinge fracture while a scar which terminates in a break at right angles to the previous fracture path is called a step fracture. Crushing is a form of flaking wear characterized by unpatterned, severe subsurface fracturing of the tool edge as force is applied to the body of the tool through impact or percussion (Ahler 1979).

Battering wear on silicious materials is characterized by conchoidal fractures resulting from impact. Macroscopically, battering consists a concentration of concoidal fractures which appear as small white rings 0.5-1.5 mm in diameter. Under microscopic examination these rings are small conical fractures extending into the body of the material. Individual fractures of this type are produced by impact of the artifact on some other material. Battering wear is often found on hammerstones or on other artifacts such as cores used as hammerstones.

Abrasive wear results in varying degrees of edge-modification ranging from highly lustrous, polished and striated surfaces to heavily rounded and worn edges. Experiments with both retouched tools and unretouched debitage on a variety of materials including wood, bone, antler, meat and animal hides have dublicated various types of abrasive wear (Ahler 1971, 1979; Chapman 1977; Keeley 1980).

Ahler (1979) has described several categories of abrasive wear visible at magnifications of 20X to 100X. Grinding is defined as a flat uniformly even surface resulting from pressure contact with hard materials such as stone or abrasive tanning agents. Blunting wear is characterized by an uneven coarse irregular surficial microtopography resulting from pressure contact with materials hard enough to produce subsurface microfracturing of the tool edge. Smoothing is slightly finer form of abrasive wear characterized by a surface less coarse or granular and slightly more reflective of light than the normal texture of the unworn the stone.

Polish is the finest level of abrasive wear and consists of a surface highly reflective of light and free from crystalline structure or other textural features (Ahler 1979). Polish may occur on the edge

perimeter or on portions of the surfaces adjacent to the edge. Due to the glassy nature of many silicious chipped stone materials, polish is one of the more difficult wear patterns to identify. Although some degrees and types of polish cannot be detected with low level magnification, others can be detected and can contribute significantly to functional interpretations (Tringham et al. 1974).

Abrasive polish has been observed on artifacts recovered from a variety of archaeological contexts. Witthoft (1967) has differentiated polish produced by abrasion from polish produced through accretion of opal. The latter results from heat generated through usage of the edge in cutting grass-like vegetal materials. Ahler (1971) reproduced slight to moderate polish on of wood whittling tools and by imbedding hafted projectile points into silty topsoil. Pronounced or heavy polish is often observed to occur in conjunction with striations. Ahler (1979) defines striations as any evidence of linear patterning in the removal of worn material.

The location of wear modification and whether it occurs on the ventral or dorsal face of the tool or both is important in establishing the motion of the tool relative to the material it was used on. Scraping, shaving or planing resulting in transverse motion of an edge producing flaking wear on one face opposite the direction of use. Longitudinal motion such as cutting and sawing produces damage on both faces of a tool (Tringham et al. 1974). Polish can occur on either or both faces or on an edge only.

The length of the utilized or modified edge provides an indication of the intensity of use. Maximum tool length parallel to a given working edge also relates to the amount of pressure that may be loaded on that edge in a given mode of prehension. For example, a small flake tool that would be held by the fingertips could not be utilized for heavy-duty tasks and step flaking wear present on such an artifact would likely be the result of intentional retouch than a result of tool use.

Inferring functions and activities from patterns of use-wear requires the integration of the variables discussed above. Not only must the wear patterns be determined, but the orientation of the tool, edge angle, type of material worked, amount of force applied, means of hafting or mode of prehension, and duration of use must be considered (Ahler 1979; Keeley 1980). The utility of use-wear assessments at low level magnification has been demonstrated by Odell (1979) and Odell and Odell-Vereecken (1980). While high level magnification studies may yield better definition of use-wear patterns (Keeley 1980; Hayden 1979), operationalizing high level magnification studies of large assemblages is difficult.

An approach utilizing low power magnification for the assessment of use-wear on edge-modified tools and higher magnification on formal tools was developed for the Blue Springs project. Such an approach allows for the rapid processing of the numerically numerous edge-modified tools while allowing for the high power study of abrasional wear on the formal tools. The later is necessary to differentiate minute flake scars resulting from manufacturing processes and intentional retouch from

flaking use-wear. Thus, use-wear interpretations of formal tools relies on abrasive wear visible at 20-100X magnification and macroscopic features such as impact fracture, while use-wear observations of informal tools is inferred on the flaking wear and abrasive wear visible at low magnifications (10-20X).

Inferences of tool function from use-wear studies is made on the basis of several variables. Formal tools displaying abrasive wear on the edge and both faces indicate use as cutting implements. Heavy-duty cutting wear (use on hard materials) is characterized by grinding or blunting of the working edge (Ahler 1979). Polish may be present but is rarely extensive (Keeley 1980). Light-duty cutting wear (use on soft to medium hard materials) is indicated when the abrasive wear consists of polish and striations running parallel to the tool edge. Combinations of grinding, blunting, smoothing, and polish indicate use on both hand and soft materials. This type of wear is referred to as general cutting wear.

The use of formal tools in scraping activities is indicated by the same abrasive wear types found in cutting tools. However, they occur on edge and on only one face of the tool. Scraping hard materials produces grinding or blunting wear referred to as heavy-duty scraping. Light-duty scraping on soft material is inferred when the tool displays pronounced polish and striations running perpendicularly to the edge perimeter. When a tool is used for both heavy and light-duty scraping, multiple types of abrasive wear may be present and the artifact is classified as a general scraping tool. Additionally, Ahler (1979) describes grinding wear associated with perpendicular oriented striations that is thought to result from working hides with an abrasive tanning agent.

On edge-modified tools cutting wear is inferred on the basis location and regularity of flaking wear and direction of flake propagation (Tringham et al. 1974; Chapman 1977; Reeder et al. 1983). Wear is typically found on both faces and is usually irregular (Ahler 1979:313). Orientation of flake scars is normally diagonal to the edge outline (Tringham et al. 1974). Light-duty cutting wear is produced by cutting soft to medium hard materials such as meat, hides, soft woods, or plant materials and is characterized by smaller flaking wear scars and a higher degree of polish (Keeley 1980). Fracture types range from snaps on low angled edges to feathering. Heavy-duty cutting wear produced by hard or seasoned woods, bone and antler results in more severe hinge or step fractures and greater depth of scarring.

Two additional functions which can be inferred from wear on projections are piercing/boring and graving/incising. These two wear types are differentiated on the basis of the thickness and strength of the projection. Use as a piercing/boring tool is indicated when wear or retouch occurs on thin narrow projection. Frequently these are thin flakes that would not be suitable for working hard materials, yet could be easily used to pierce small animal hides or bore into materials such as soft woods. Graving/incising tools are inferred when wear occurs on projections formed on thick flakes, frequently on a corner forming a trihedral pyramidal bit. These tools are suitable for applying

considerable force that would be necessary for incising bone or antler, and thus they are considered heavy-duty tools. There presence of a projection on a utilized or retouched flake does not qualify it for inclusion as a piercing/boring or graving/incising tool; the wear must be more prominent on the projection, or the retouch oriented to form or shape the projection.

Scraping function are characterized by regular rows of flake scars oriented perpendicularly to the edge outline on one face of the tool. Light-duty scraping activities performed on soft materials such as wood produce lighter degrees of fracture wear and more polish. Scraping on harder materials (hardwood, bone, antler) referred to as heavy-duty scraping results in hinge, step, and crushing fractures with longer flake scars (Keeley 1980) and more rounding of the edge (Chapman 1977).

Chipped Stone Tool Classification

Bifacial Tools: Several classes of bifaces can be recognized on the basis of morphology and evidence of utilization. Projectile points are symmetrical bifaces which have a proximal haft element and laterally convergent edges forming a distal point. They are generally considered to be designed to serve as projectile tips. However, this may not always be the case, Ahler (1971) has found that tools generally classified as projectile points exhibited wear patterns indicative of other usages.

Haft element modifications on projectile points can consist of side or corner notches, a basal stem or thinning of the base by removal of one or more large flakes. The presence of such modifications indicates that the artifact was intended to be mounted on the end of a shaft for use as a piercing tool. However, some bifaces which do not exhibit haft modifications are traditionally classified as projectile points. The size, outline and edge characteristics of these tools precludes most other uses. Small symmetrical triangular bifaces referred to as arrow points are examples. Generally, only projectile points with part of the haft element present are identifiable as projectile points.

Bifacial drills are symmetrical bifaces with parallel-sided narrow bits with a bicomex or diamond shaped cross-section. They are usually well formed tools with fine pressoure retouch along the bit, if not the entire margin of the tool. The proximal end of drills often exhibits a haft element similar to that found on projectile points. Drills frequently exhibit use-wear indicating a rotary motion. Performs are thinned unstemmed bifaces, usually exhibiting fine pressure retouch along the entire margin. Biface that reached this point in the reduction sequence could be utilized as knives without further modification or further modified into projectile point or drills.

Bifacial knives are bifaces whose morphology and edge wear indicate use as a cutting tool. They are generally unstemmed and triangular to ovate in plan form. At least one edge must exhibit abrasive cutting wear. It should be recognized that micro flaking damage on edges can result from platform preparation or fine retouching, as well as from use

as cutting tools. The presence of abrasive wear is generally considered necessary to separate knives from preforms.

Bifacial blanks are bifaces that did not reach the final stages of the lithic reduction sequence. They range from thick blocky specimens with only initial shaping to well formed artifacts with secondary thinning. Blanks include unfinished tools and tools broken during manufacture as well as, bifaces discarded due to flaws in the raw material. Blanks frequently exhibit use-wear indicating that even though they were rejected as unsuitable for further reduction, they were later used as tools.

Bifacial scrapers are classified on the basis of the presence of steep planoclinal retouch and wear indicative of use as a scraping tool. Many bifacial scrapers appear have been secondarily utilized as scrapers and do not appear to have been manufactured primarily for use as a scraper. Frequently, only a small portion of the working edge was utilized as a scraper.

Unifacial Tools: The majority of unifacial tools are various types of scrapers such as end or side scrapers. These tools have ovate to subtriangular plan forms with a steeply angled working edge. Unifacial flaking extends over most of the dorsal surface of the flake blank. Unifacial scrapers are generally considered to be hideworking tools.

Marginally Retouched Tools: Marginally retouched tools include flake scrapers, gravers and perforators. Flake scrapers are characterized by a steep angle of retouch, while gravers are characterized by a projection often with a backing on the opposing edge. Perforators consist of tools with marginal retouch forming a projection suitable for piercing.

Edge-Modified Tools: These tools make up the majority of artifacts from the sites and are informal implements which exhibit either marginal retouch extending over less than one third of the perimeter of the artifact or exhibit modification consisting of use-wear along the perimeter of the tool. These tools are usually subdivided into debitage categories such as edge-modified flakes, edge-modified chunks and edge-modified cores. Such tools are rarely curated or maintained.

Lithic Manufacturing Debris

Lithic manufacturing debris comprises the majority of the lithic assemblage from the sites. This material is subdivided into cores, chunks, flakes and chips. Cores are pieces of chert which exhibit patterned negative flake scars from which flakes were removed by percussion. Several classes of cores are recognized on the basis of size, shape, degree of platform preparation and flake scar patterning.

Block cores are large pieces of chert irregular in shape which exhibit one or more natural striking platforms. They are distinguished by their large size and a thickness which is at least one half or more than the largest dimension. Flakes removed consist of

large expanding flakes with minimal platform preparation. Tabular cores differ from block cores in that their thickness is one half or less than the maximum dimension. They differ morphologically as well in that they are more quadrilateral in cross-section. Like the block cores, tabular cores exhibit minimally prepared natural striking platforms from which large expanding flakes were detached. Nodular cores are naturally eliptically shaped pieces of chert. Although generally smaller than block or tabular cores, they also exhibit an expanding flake pattern and minimally prepared, natural striking platforms. Prepared cores exhibit systematic platform preparation for the removal of lamellar or parallel edged flakes. They tend to be pyramidal in shape. These differ from true blade cores in that the negative flake scars tend to be less parallel-sided and not as elongated.

Core nuclei are worn out or exhausted cores which exhibit negative flake scars. Given their small size and degree of reduction, it is generally not possible to determine whether they were derived from any of the core types described above. Core fragments are cores that exhibit evidence of systematic flake removal and natural angular cleavage planes. Core fragments are amorphously shaped and are probably sections of larger block cores or tabular cores that prematurely fractured along pre-existing fracture planes.

Chunks are of angular multifaceted pieces of chert greater than 3 cm in maximum dimension. They exhibit none of the systematic flake removal associated with cores nor any of the morphological characteristics of flakes. Most represent trimming elements removed during the initial reduction of a core. Cortical chunks are simply chunks that exhibit one or more cortical surfaces.

Debitage consists of generalized waste flakes and shatter detached by direct or indirect pressure or percussion during the reduction of cores and manufacture of chipped stone tools. Debitage exhibits no evidence of post-detachment modification such as intentional retouch or utilization. Flakes are recognized by characteristics such as the presence of striking platforms, bulbs of percussion and ripple marks. The general category of flakes includes decortication flakes, intermediate flakes, bifacial trimming flakes and chips. Decortication flakes have a minimum dimension of 2 cm and exhibit at least 50 percent or more cortex on their dorsal surface. They represent the initial stages of lithic tool manufacture and are often referred to as primary decortication flakes. Intermediate flakes have a minimum dimension of 2 cm but exhibit less than 50 percent cortex on their dorsal surfaces. They represent the intermediate stages of lithic reduction and tool manufacture and include secondary decortication flakes as well as primary and secondary trimming flakes. Bifacial trimming flakes are recognized by the presence of multifaceted platforms which exhibit characteristic 'lipping' of the striking platform over the vertical surface of the flake. These elements are very thin and have small negative flake scars on their dorsal surface. Bifacial trimming flakes are representative of the final stage of lithic tool manufacture and maintenance. Chips are simply flakes less than 2 cm in maximum dimension.

Small pieces of chert less than 3 cm in maximum dimension that are irregular in shape and lack characteristics of flakes are classified as shatter. Pieces of shatter do not have evidence of conchoidal fracture. They may have resulted from breakage along the chert's natural cleavage planes, excess force applied during lithic reduction, heat treatment, treadage or noncultural factors such as freeze-thaw action. Shatter also includes some unidentifiable flake fragments.

SUMMARY

In summary, the 1983-1984 Blue Springs Lake archaeological mitigation program was directed at the excavation of an early Middle Archaic component at 23JA143, a late Middle Archaic component at the Cold Clay site (23JA155) and Middle Woodland, Late Woodland and Mississippian period May Brook phase components at the Black Belly site (23JA238). Research goals for the project included investigation of the alluvial chronology of the Little Blue River, definition of vegetational communities in the Little Blue River, investigation of Archaic, Woodland and Mississippian culture history and Archaic, Woodland and May Brook phase settlement-subsistence patterns. Since previous work in the Little Blue valley indicated that the predominant prehistoric adaptative pattern consisted of hunter-gatherer foraging and collecting, the major focus of settlement-subsistence research was directed at defining the nature and duration of occupation at the sites. In order to address these goals, a techno-functional lithic analytical system including use-wear analysis was developed.

CHAPTER II

GEOMORPHOLOGY OF THE LITTLE BLUE DRAINAGE BASIN

Rolfe D. Mandel

INTRODUCTION

The geomorphology of the Little Blue drainage basin was examined in order to develop a model of landscape evolution in the project area. The study included general terrain analysis and field examination of specific landforms, geomorphic surfaces, sediments, and soils. Absolute and relative time relationships were used to determine the alluvial chronology of the Little Blue valley. The information gained from the geomorphological investigation is integrated with the record of Holocene bioclimatic change in western Missouri.

PHYSIOGRAPHIC SETTING

The Little Blue River is in the Cherokee Lowlands region of the Central Lowlands Physiographic Province. The valley of the Little Blue trends south-southwest to north-northeast. It is approximately 27 km long and drains an area of about 673 square kilometers. The Little Blue River is a fourth order stream, and it joins the Missouri River approximately 23 km north of Blue Springs, Missouri. The drainage system lies at elevations ranging from about 216 m to 290 m above sea level. The vertical relief in the Little Blue valley is about 37 m from the valley floor to the uplands.

The Little Blue River flows along a course developed primarily in silty alluvium. In the area of Longview Lake the channel flows over Pennsylvanian shale and limestone. The valley walls are composed of alternating layers of shale and limestone that are covered by loess or colluvium in most locations. Thick deposits of late Pleistocene loess blanket the interfluves.

The major landforms of the Little Blue valley pertinent to this study are two river terraces. The lowest terrace (T-0) is located adjacent to the modern river channel. An older and topographically higher terrace (T-1) makes up most of the rest of the valley floor. Other landforms occurring within the valley are meander scars on the T-0 and T-1 surfaces; alluvial fans and colluvial deposits in footslope positions; and small scale erosional forms such as gullies and rills on valley slopes and terrace surfaces. The following discussion provides detailed descriptions of soil-geomorphic relationships in the Little Blue valley.

ALLUVIAL SOILS AND GEOMORPHIC SURFACES

The distribution of soils in the Little Blue valley can serve as an important and simple means of identifying and mapping the floodplain and terrace surfaces. This is because soil properties reflect the relative age, geomorphic stability, and drainage characteristics of the surfaces beneath which the soils formed.

The soils in the Little Blue valley are mapped in the recent Soil Survey of Jackson County, Missouri (Preston 1984). Six alluvial soils, termed Kennebec, Colo, Bremer, Zook, Wabash, and Wiota, are recognized in the project area. Figure 5 shows the soil-geomorphic relationships within the Little Blue valley.

The Kennebec soils occur on natural levees and low floodplain (T-0) surfaces bordering the Little Blue River and its tributaries. These soils formed in silty alluvium that is less than 15 percent sand. The Kennebec soils are characterized by weakly developed A-C profiles; they have not developed long enough to form B horizons. Although the surfaces associated with these soils are moderately well drained, they are subject to frequent flooding.

The Colo soils occur on low surfaces of the T-1 Terrace that are relatively close to stream channels. The Colo soils, in contrast to the Kennebec series, possess moderately developed profiles with cambic B (Bw) horizons. They are flooded less frequently than the Kennebec soils, but they are more prone to flooding than the higher Bremer and Wiota soils.

The Zook and Wabash series are made up of deep, poorly drained, slowly permiable soils on T-1 surfaces. Both soils occupy areally extensive backwater areas bordering the Little Blue River. These poorly drained areas collect pond surface runoff from floods and precipitation allowing for the deposition of fine sediment. Zook soils are common in the lower and middle reaches of the Little Blue River. Wabash soils are also common in the lower reaches of the river, but they disappear in the middle reaches as the gradient of the valley floor increases. The Zook and Wabash soils are characterized by thick silty clay loam and silty clay A horizons overlying silty clay B horizons. The B horizons are gleyed and have fine and medium angular blocky structure.

The Bremer series consists of deep, poorly drained soils on T-1 terraces. These soils are at slightly higher elevations, and are further from stream channels, than the Colo, Zook and Wabash soils. The Bremer soils have strongly developed profiles with thick argillic B (Bt) horizons. Argillic horizons form over relatively long periods of time as clay is mobilized and translocated downward in the profile to accumulate in the B horizon. The presence of translocated clay is indicated by high clay content in the B horizon (relative to the A) and by clay films on the surfaces of peds (Soil Survey Staff 1975). Since clay translocation and accumulation require both time and surface stability, an argillic horizon in a soil profile is an indicator of relatively long term geomorphic stability. Thus, the Bremer soil is

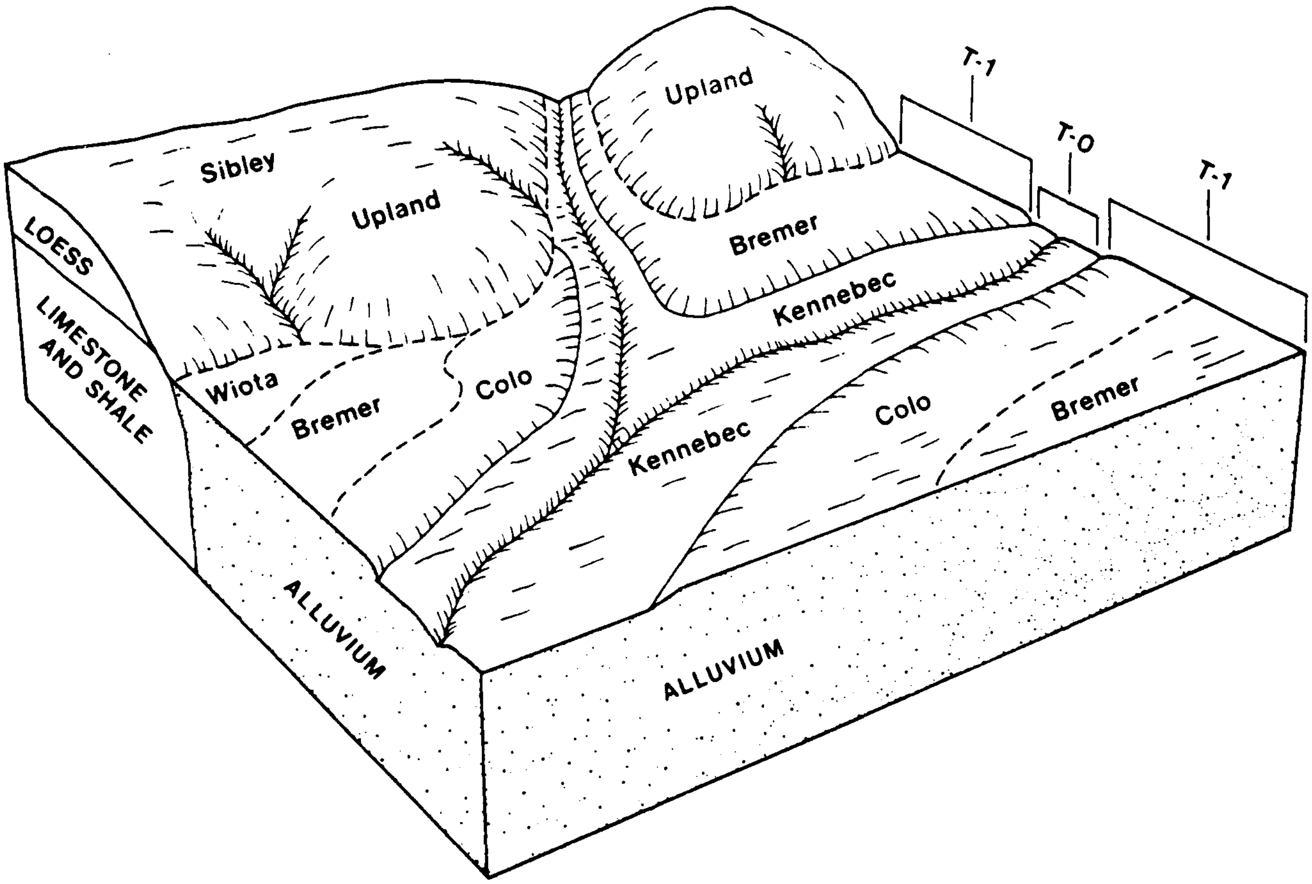


Figure 5. Relationship of soils and landscapes in the Little Blue Valley.

Table 2. Radiocarbon dates and geomorphic associations.

SITE	DATE B.P.	LAB NO.	DEPTH BELOW SURFACE (m)	TERRACE	SOIL
23JA238-1	680±65	DIC-1603	1.30	T-0	Kennebec
23JA238-2	1620±45	DIC-1680	.50-.88	T-1	Colo
23JA238-3	1310±60	Beta-8538	.36-.40	T-1	Colo
23JA238-4	1390±60	Beta-12786	.31-.56	T-1	Colo
23JA238-5	1960±90	Beta-8537	.60-.70	T-1	Colo
North of 23JA238	1460±55	DIC	2.50	T-1	Kennebec
23JA143-1	1620±70	DIC-1683	.54	T-1	Zook
23JA143-2	6580±120	Beta-12001	3.50-3.60	T-1	Buried Soil
23JA143-3	6660±100	Beta-8535	3.50-3.60	T-1	Buried Soil
23JA155-1	4245±170	Beta-1325	1.26-1.33	T-1	Buried Soil
23JA155-2	5550±100	Beta-12000	2.60-2.70	T-1	Buried Soil
23JA155-3	5590±120	Beta-8536	2.78-2.82	T-1	Buried Soil
23JA43-1	150±80	DIC-1523	.70	T-0	Kennebec
23JA43-2	730±130	DIC-1526	1.10	T-0	Kennebec
23JA43-3	780±90	DIC-1522	1.30	T-0	Kennebec
23JA43-4	1420±125	DIC-1525	1.40	T-0	Kennebec
23JA191	1205±65	UGa-2977	2.70	T-0	Kennebec
23JA40a	1850±140	UGa-2350	-	T-1	Bremer
23JA110a	2300±110	UGa-2351	-	T-1	Bremer
23JA110b	2220±195	DIC-914	.20	T-1	Bremer
23JA159a	2345±70	UGa-2535	.40-.50	T-1	Bremer
23JA159b	2455±80	UGa-2404	.40-.50	T-1	Bremer
23JA36	2400±85	UGa-1873	-	T-1	Bremer
23JA9	4120±195	DIC-1682	1.60	T-1	Bremer
East of 23JA164	2400±65	DIC-1604	2.10	T-1	Colo
11-Sept-2	8060±90	DIC-1569	7.10	T-1	Bremer

associated with T-1 surfaces that are infrequently flooded.

The Wiota series consists of deep, well drained, moderately permeable soils on T-1 surfaces in lower reaches of the Little Blue River. These soils are at slightly higher elevations, and are better drained, than the Colo, Zook, Wabash, and Bremer soils. The Wiota soils, like the Bremer silt loam, have strongly developed argillic B (Bt) horizons. However, the Wiota soils are more oxidized than the Bremer soils. The chroma of the B horizon in the Wiota soils is 3 or 4, compared to 1 or 2 for Bremer soils. Chroma is a general indicator of the extent of weathering in soil, higher chroma being associated with more advanced pedogenesis. The relatively high chroma of Wiota soils may be attributed to good drainage on T-1 surfaces with these Wiota soils. Also, the Wiota soils occupy stable landscapes that are rarely flooded. Landscape stability promotes strong soil development.

In summarizing the soil-geomorphic relationships, the Kennebec soils are associated with low, frequently flooded T-0 surfaces adjacent to stream channels in the Little Blue drainage basin. The Colo series also occur near stream channels, but they are at slightly higher elevations than the Kennebec soils. Colo soils are occasionally flooded. The Bremer soils occur at higher positions on the T-1 surfaces, and are further from stream channels than the Colo series. Zook and Wabash soils occupy broad backwater areas on the T-1 Terrace; they frequently pond surface runoff due to poor drainage. Wiota soils occur on the highest surfaces of the T-1 Terrace; they are well drained and rarely flooded.

ALLUVIAL STRATIGRAPHY AND CHRONOLOGY

The geomorphic history of the Little Blue drainage has been examined in a number of earlier studies (e.g., Filer and Sorenson 1977; Johnson 1978; Kopsick 1980, 1982; Anderson 1981; Filer 1981). These studies concentrated on the Holocene and late Pleistocene deposits which make up the valley bottoms. Previous geomorphological investigations of the Little Blue drainage were concerned with landscape evolution and with the potential for buried archaeological sites. They focused on the alluvial chronology of the Little Blue and on the erosional and depositional processes operating within its drainage basin. The results of these studies are summarized in the following discussion.

Filer and Sorenson (1977) conducted a soil-geomorphic study of archaeological sites in the areas of Longview and Blue Springs Lakes. They used particle size data from 22 deep cores to interpret the recent geomorphic history of the Little Blue River valley. More specifically, variations in particle size distribution within sediment cores were used to determine whether changes in channel position or energy levels of streams had occurred. Sediment data were also used to determine sources of valley fill. They noted that the valley fill of the Little Blue River and of the East Fork of the Little Blue River consists almost entirely of reworked loess. For the most part, the cores did not show large variations in particle size distribution with increasing depth below the surface. They suggested that the uniformity of the sediments is a result of stable energy levels in streams and of consistent sediment contributions from the loess-rich basin. No major changes in channel position were located, and they noted that there is no evidence of post-settlement alluvium overlying pre-settlement soils.

More recently, Filer (1981) and Anderson (1981) suggested that the consistent particle size distribution and the lack of sand lenses in most of the sampled alluvial deposits of the Little Blue River indicate the absence of major fluctuations in late Holocene depositional environments. Filer (1981:390) also noted that no buried paleosols were found in floodplain or terrace deposits. She concluded that there have been no dramatic changes in rates of erosion on the valley sides or uplands during the Holocene.

Johnson (1978) investigated soil-geomorphic relationships at the Sohn site in the upper Little Blue River valley. He identified two river terraces at the site. The lowest terrace is considered to be very late Holocene in age, probably less than 1000 years old. This deposit is the modern flood plain (T-0) of the Little Blue River. Johnson correlated the T-0 with the Pippins alluvium (T-0) in the lower Pomme de Terre River basin of western Missouri. A weakly developed paleosol was noted 76-91 cm beneath the T-0 surface. The material above the paleosol is presumed to be post-settlement alluvium. The second terrace (T-1) is about two meters above the T-0, and it has a better developed surface soil as compared to the T-0 surface. Johnson suggested that the T-1 alluvium began accumulating about 11,000 years ago, and ceased accumulating (except for occasional overbank deposition) about 2000 years ago. He correlated the T-1 terrace of the Little Blue River with the Rodger's alluvium (T-1) in the Pomme de Terre River valley.

Kopsick (1980) investigated the alluvial sequence of May Brook in the Little Blue drainage. May Brook is located about 4.0 km upstream from the confluence of the mainstem and the East Fork of the Little Blue River. According to Kopsick, there are four depositional units (I-IV) that make up the alluvium in May Brook valley. The T-0 deposit (Units II-IV) is an aggrading floodplain adjacent to the modern stream channel. Charcoal from near the base (Unit II) of this deposit was dated at 1455±125 years B.P. A paleosol was identified approximately 60 cm beneath the surface of the T-0 deposit. This paleosol marks the top of Unit III. A radiocarbon date of 185±80 years B.P. was determined on charcoal from the buried soil. Kopsick correlated the buried paleosol in the T-0 deposit with the buried A horizon identified by Johnson (1978) in the T-0 deposit at the Sohn site. The surface of the T-1 terrace of May Brook (Unit I) is almost 2 meters above the T-0 surface. A Middle Woodland component was discovered within the upper 20 cm of the T-1 fill.

A more recent investigation by Kopsick (1982) provides a stratigraphic framework that is a significant revision of earlier geomorphic investigations of the Little Blue drainage. Based on Kopsick's 1982 study, the bottomlands of the Little Blue River consist principally of two terraces: the T-0 and T-1. The T-0 has a narrow, slightly elevated surface closely paralleling the modern channel. Most of the valley bottom consists of the T-1 terrace, which is elevated 4 to 5 m above the present channel. Unlike Filer's (1981) description of the floodplain, Kopsick noted that there is abundant evidence of past stream meandering on the T-1 surface. This evidence is in the form of numerous channel scars and oxbow lakes. Kopsick (1982) also suggested that an older T-2 terrace occurs in some of the small, protected tributary valleys of the Little Blue drainage.

The oldest date for T-1 sediments is from the East Fork of the Little Blue (Kopsick 1982). A date of 8060±90 years B.P. was determined on a piece of wood about seven meters below the T-1 surface. Kopsick (1982) also reported radiocarbon dates of 4180±95 and 4120±195 years B.P. that were determined on non-cultural carbon at depths of 2.2 and 1.6 m below the T-1 surface, respectively. The rest of the dates from the T-1 deposit range in age from roughly 3000 to 2000 years B.P.

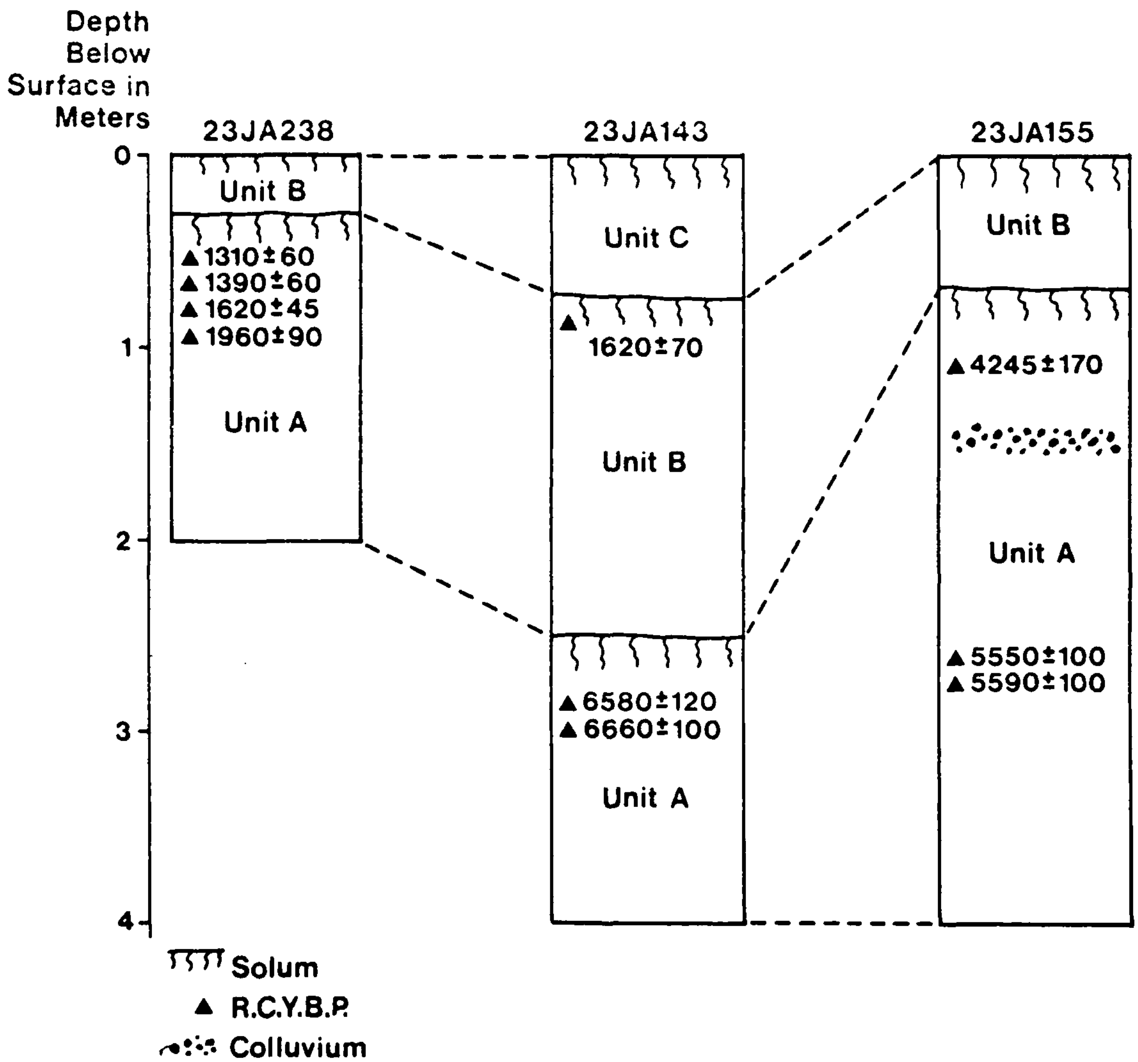


Figure 6. Stratigrahic comparisons of 23JA143, 23JA155 and 23JA238.

According to Kopsick, the high number of Woodland sites located on the T-1 surface suggests that this terrace was aggrading during Archaic times. He suggested that T-1 deposition must have slowed or stopped around 2000 years ago since Woodland sites are not deeply buried beneath the T-1 surface.

In the present study, the soil-stratigraphic evidence indicates a more complex geomorphic history for the Little Blue River than the one presented by Filer (1981) and Kopsick (1980,1982). This evidence shows that alluvial processes in the Little Blue valley consisted of episodes of rapid deposition followed by periods without any significant deposition during which soils formed. Cycles of deposition, stability, and erosion resulted in complex soil-stratigraphic sequences. The best example of this complexity is at site 23JA143.

The excavation of 23JA143 revealed three depositional units and two buried paleosols beneath a T-1 surface (Schmits et al.: this volume). A levee deposit (Unit C) overlies a paleosol formed in silty floodplain sediments (Unit B). The buried paleosol at the top of Unit B is 77 cm below the surface of the terrace. A second buried paleosol occurs at a depth of 2.5 m below the terrace surface. It is developed in clayey, organic-rich sediments (Unit A) that were probably deposited in a backwater area of the floodplain.

The soil-geomorphic record at 23JA143 indicates that there were at least three aggradation episodes. These are evidenced by (1) the fine grained facies of Unit A; (2) the silty alluvium of Unit B; and (3) the silty levee sediments of Unit C. Episodes of relative geomorphic stability are represented by the paleosols developed in Units A and B.

Although only two dates are available for Unit A at 23JA143, this deposit is probably early to middle Holocene in age. The base of the unit is undated, but radiocarbon dates of 6660 ± 100 and 6580 ± 120 years B.P. were determined on charcoal from a Middle Archaic cultural horizon 40 cm below the surface of the paleosol in Unit A. Thus, Unit A aggradation probably ended soon after 6660 years B.P. The episode of geomorphic stability indicated by the paleosol at the top of Unit A was interrupted by rapid aggradation of Unit B. The archaeological record indicates that Unit B aggradation slowed or ended by at least ca. 1600 years B.P. A radiocarbon date of 1620 ± 70 years B.P. was determined on charcoal from a Middle Woodland component in the upper 20 cm of Unit B. A second episode of geomorphic stability is indicated by a soil developed at the top of Unit B. This soil exhibits a moderately developed profile, including a cambic B horizon. As a result of recent fluvial activity, the soil at the top of Unit B was buried by silty sediments of Unit C. Unit C sediments occur as levee deposits immediately adjacent to the stream channel. A weakly developed surface soil with an A-C profile has formed in Unit C.

The soil-stratigraphic record at 23JA238 is similar to that at 23JA143 (Schmits: this volume). However, only a single buried paleosol was exposed in the T-1 deposit at 23JA238. The stratigraphy of the site consists of two major depositional units, referred to as Units A and B. The lowermost deposit, Unit A, is composed of silty alluvium. An

episode of landscape stability is indicated by a formed at the top of Unit A. This soil has a moderately developed cambic B horizon. The B horizon is truncated at the contact with the overlying unit, indicating that the surface of Unit A was eroded prior to its burial by Unit B. Unit B is a silty levee deposit that has a thickness of 20-30 cm. The surface soil in Unit B is characterized by a weakly developed A-C profile.

Radiocarbon dates determined on charcoal from a Middle Woodland occupation 20-40 cm below the top of Unit A indicate that Unit A aggradation slowed or ended by at least ca. 2000 years B.P. The Middle Woodland cultural horizon yielded dates of 1960±90 and 1620±45 years B.P. A Late Woodland component in the upper 20 cm of Unit A produced dates of 1390±60 and 1310±60 years B.P.

Based on the soils and radiocarbon data at 23JA238, the buried paleosol at the top of Unit A is correlated with the buried paleosol in Unit B at 23JA143. At both sites, the uppermost buried soils have moderately developed cambic horizons formed in silty floodplain sediments. In addition, Middle Woodland components are buried within the upper 50 cm of these near-surface paleosols. The sites date between ca. 2000 and 1600 years B.P.

Unit B aggradation at 23JA238 and Unit C aggradation at 23JA143 were also probably synchronous. These units are thin levee deposits with weakly developed surface soils. It is likely that the levee deposits are products of overbank deposition during very late prehistoric or recent times.

The excavation of 23JA155 provided an opportunity to examine alluvial and colluvial deposits near the walls of the Little Blue valley (Schmits: this volume). The stratigraphy at 23JA155 consists of two depositional units separated by a buried paleosol. The lower deposit (Unit A) is composed of silty T-1 sediments with lenses of colluvium. Unit A is at least 3.0 m thick, and it has a soil developed in its surface. The buried paleosol at the top of Unit A is 70 cm below the land surface. It has a strongly developed argillic (Bt) horizon that was truncated prior to the deposition of Unit B. Unit B is composed of both slope wash from the adjacent hillside and of alluvium from the Little Blue River. The modern surface soil is developed in Unit B.

The time-stratigraphic data from 23JA155 indicate that Unit A aggradation was initiated at some time prior to ca. 5600 years B.P. Radiocarbon dates of 5550±100 and 5590±100 years B.P. were determined on charcoal recovered 1.90 m and 2.08 m below the surface of Unit A, respectively. The absence of soil development in the lower two meters of Unit A suggests that this episode of deposition was rapid. A thin bed of colluvial chert gravel laterally interfingers with T-1 alluvium at a depth of 80 cm below the surface of Unit A. The colluvium is a product of hillside erosion that occurred soon after ca. 5550 years B.P. Aggradation of T-1 sediments slowed towards the end of the middle Holocene, and the surface of Unit A became stable by around 4000 years B.P. This episode of geomorphic stability is marked by a strongly

developed soil at the top of Unit A. A data of 4245±170 B.P. was determined on humic acids from the Bt2 horizon of the buried paleosol. The period of landscape stability was interrupted by an erosional event that truncated the paleosol at the top of Unit A. This was followed by rapid alluviation and colluviation, resulting in the burial of Unit A by clayey silt (Unit B). The development of the modern soil on the T-1 surface reflects the termination of Unit B aggradation a condition that would have allowed pedogenesis to proceed.

There clearly are stratigraphic and chronological similarities between sites 23JA155, 23JA238, and 23JA143 (Figure 6). At 23JA155 and 23JA143, silty and clayey overbank sediments (Units A) were rapidly accumulating on the floodplain of the Little Blue River during the early and middle Holocene. This episode of aggradation was interrupted by geomorphic stability and concomitant soil development sometime between ca. 6600 and 4000 years B.P. Renewed aggradation resulted in the burial of the Unit A paleosol at 23JA143 and 23JA155. This episode of aggradation is represented by Units B at both 23JA143 and 23JA155, and by Unit A at 23JA238. Aggradation slowed at the three sites during the late Holocene, and a moderately developed soil formed on the T-1 surface around ca. 2000 years B.P. This soil was buried by post-settlement alluvium at 23JA143 and 23JA238.

The pedological evidence suggests that the surfaces of the T-1 terrace stabilized between ca. 2000 and 1500 years B.P. As noted earlier, the soils on the T-1 terrace exhibit moderately and strongly developed profiles, including cambic and argillic B horizon. Cambic horizons, such as those observed at 23JA143, 23JA155, and 23JA238, generally form in less than 2000 years (Parsons et al. 1970). However, accumulations of clay sufficient to be recognized as argillic horizons require about 2000 years to develop (Bilzi and Ciolkosz 1977). It is tentatively suggested that the soils on low T-1 surfaces near stream channels began to form soon after 2000 years B.P. in response to slowing aggradation. These soils, which include the Colo series, are characterized by cambic horizons. Soil development was probably well underway by 2000 years B.P. on high T-1 surfaces. These soils, which include the Bremer and Wiota series, have strongly developed profiles with argillic horizons.

Based on the findings of the present and previous studies, the geomorphic history of the Little Blue River is as follows. The T-1 deposits, which occupy the bulk of the valley floor, were aggrading by at least ca. 8000 years B.P. Rapid aggradation was interrupted by geomorphic stability and soil development at 23JA143 and 23JA155 sometime between ca. 6660 and 4000 years B.P. It is not known whether this episode of stability was a valley-wide event. At 23JA155, an episode of intense upland erosion occurred sometime between ca. 5550 and 4250 years B.P. Valley alluviation appears to have continued until about 2500 years B.P. After 2500 years B.P., aggradation must have slowed or stopped since radiocarbon dates from the upper 50 cm of the T-1 deposits range in time from roughly 2400 to 1300 years B.P. (Table 2). The pedological and archaeological data suggest that the T-1 surfaces stabilized between ca. 2000 and 1500 years B.P.

Around 1500 years B.P., the Little Blue River began a downcutting episode, leaving the former floodplain surface as the T-1 terraces. This downcutting was well underway by ca. 1460 years B.P. and has continued to the present. Occasional overbank deposition contributes sediment to the modern floodplain (T-0) and to low T-1 surfaces.

REGIONAL CORRELATIONS OF HOLOCENE ALLUVIAL SEQUENCES

The episodes of fluvial activity which produced the terrace system in the Little Blue River valley can be related to similar sequences within the East-Central Plains. As noted earlier, the geomorphic evidence suggests that the floodplain of the Little Blue River was rapidly aggrading during the early Holocene. A similar episode of rapid aggradation was recorded in west-central Missouri (Ahler 1976; Brakenridge 1981), in western Iowa (Thompson and Bettis 1980) and in eastern Kansas (Schmits 1980a). At Rodgers Shelter in west-central Missouri, an erosional episode during the Pleistocene/Holocene transition was followed by the rapid alluviation of a brown, clayey silt 10,000 to 8100 years B.P., a brief episode of erosion 8100 to 7500 years B.P. and then the depositon of alluvium to the former floodplain level until about 5000 years B.P. (Brakenridge 1981). In western Iowa, alluvium was transported out of the upper reaches of the drainage networks during the early and mid-Holocene and accumulated in alluvial fans and in large valleys (Thompson and Bettis 1980). Schmits (1980a) noted that rapid aggradation was occurring as late as 6285 years B.P. at the Coffey Site in eastern Kansas.

At 23JA155, a mid-Holocene episode of intense upland erosion is indicated by a zone of colluvium in the upper meter of Unit A. Based on bracketing radiocarbon dates, colluviation occurred sometime between ca. 5550 and 4250 years B.P. At Rodgers Shelter, an episode of intense upland erosion is indicated by accumulations of colluvium and coarse alluvial fan gravels, beginning at ca. 7480 years B.P. and continuing to at least 5130 years B.P. (Ahler 1976). At the Koster site in western Illinois, colluviation began around ca. 8750 years B.P. and continued until ca. 4000 years B.P. (Wiant et al 1983). The early through mid-Holocene episodes of upland erosion at Rodgers Shelter and Koster have been attributed to a reduction of vegetation cover in response to decreased precipitation during the Hypsithermal (Ahler 1976; Wiant et al. 1983).

Geomorphic evidence from the Little Blue River valley and from other streams in the East-Central Plains indicates a shift from aggradation or soil formation to entrenchment at ca. 2000-1000 years B.P. Aggradation appears to have slowed in the Little Blue valley around 2500 years B.P., and the presence of a strongly developed soil on the T-1 surfaces suggests that these landscapes were relatively stable by ca. 2000 years B.P. After 2000 years B.P., but before ca. 1460 years B.P., the Little Blue incised its channel and the modern floodplain (T-0) began to aggrade. Similar fluvial sequences are documented in

Kansas and west-central Missouri. Artz (1983) noted that T-1 surfaces in the East Branch Walnut River valley of south-central Kansas experienced valley-wide aggradation from at least ca. 4500 to 2000 years B.P. By 4000 years B.P., aggradation had slowed, permitting soil development on the T-1 surfaces. At or soon after 2000 years B.P., the East Branch Walnut and its tributaries entrenched and valley-wide aggradation of T-1 surfaces ceased. The modern floodplain (T-0) aggraded between 1850 years B.P. and the present. At the Coffey site on the Big Blue River in northeastern Kansas, soil formation was underway on the surface of the T-1 terrace between ca. 2300 and 2000 years B.P. (Schmits 1980). This episode of soil development was interrupted by renewed aggradation soon after ca. 2000 years B.P. Archaeological and geomorphic data from the Perche-Hinkson drainage basin in west-central Missouri indicate that the surfaces of the T-1 terrace stabilized sometime between 3000 and 1000 years B.P. (Mandel et al. 1985). Radiocarbon dates from T-0 deposits indicate that modern floodplains in the Perche-Hinkson system have been aggrading since at least 1000 years B.P.

It is apparent that the East-Central Plains witnessed rough synchroneity of fluvial events during the Holocene. Several authors have suggested that climatic changes may be the underlying cause behind episodes of fluvial activity (cf. Knox 1976, 1977, 1984; Wendland and Bryson 1974). Knox (1976) suggested that synchronous fluvial discontinuities occur form global climatic changes. These discontinuities are reported from over 800 radiocarbon samples recovered from alluvial deposits. The approximate dates are 9800, 8500, 4600 and 2500 years B.P. Knox's model suggests a simple cause-effect relationship between climatic change and sedimentation. For example, Knox (1984) argued that early Holocene aggradation occurred in response to the increasing arid conditions of the Hypsithermal. He suggested that a shift to drier conditions promotes hillslope erosion and concomitant stream aggradation, while a shift to wetter conditions promotes hillslope stability and stream entrenchment. On the other hand, Schumm (1974, 1976) suggested that a fluvial system may respond to a change in a complex rather than a simple manner. Instead of responding to the rejuvination by simply incising, a stream may respond by alternately incising and aggrading until an equilibrium is established. Schumm (1976) pointed out that the fluvial system can be described in relation to geomorphic thresholds. Changes in the fluvial system do not occur until thresholds are equalled or exceeded.

It is likely that intrinsic and extrinsic factors in the fluvial system of the Little Blue River valley have interacted to produce periods of stability and instability. In other words, while climatic factors (extrinsic) may initiate a geomorphic response in the drainage system, the timing of the response may be controlled by local conditions (intrinsic), such as floodplain gradient and bedrock geology. Regardless of the cause(s), it is apparent that there have been several major episodes of fluvial activity in the Little Blue River valley during the Holocene.

CHAPTER III

VEGETATION IN THE LITTLE BLUE RIVER VALLEY, JACKSON COUNTY, MISSOURI

Ralph E. Brooks

The Little Blue River valley, Jackson County, Missouri, lies within the North American Prairie Province as described by Cronquist (1982). Kuchler (1964) more appropriately recognizes the area as being a mosaic of three distinct vegetation types: (1) Oak-Hickory Forest, (2) Northern Floodplain Forest, and (3) Bluestem Prairie.

Physiographically, the area lies midway between the eastern edge of the Great Plains and the Ozark Plateau in an area known as the Scarped Plains or the Interior Lowlands (Schoewe 1949). It is a region of plains and escarpments that trend northeast and southwest forming rolling uplands that drain to the Missouri River.

During the most recent glacial events, the area was apparently covered by cool season grasslands and scattered areas of spruce-aspen woodlands (P.V. Wells, University of Kansas, Botany Department, Lawrence, pers. Comm.). Since about 12,000 B.P., the warming climate of the region resulted in a gradual change of the vegetation to that described by Cronquist (1982) and Kuchler (1964). Today the potential vegetation consists of Bluestem Prairie in the uplands, Oak-Hickory Forests on many of the slopes, and a mixture of Northern Floodplain Forest and Bluestem Prairie, in the lowlands. Although the historical record of the development of the recent vegetation is poorly understood, it is guessed that the basic species composition has been established for some 5000 years (Wells, pers. comm.). There were minor periods of cooling and warming, however, that did cause fluctuations in the boundaries between the vegetation types. Even in the past 50 years, minor changes of this type have been noted in this and neighboring areas.

RECENT VEGETATION SURVEYS - AN HISTORIC ACCOUNT

Early accounts of the vegetation in the region by explorers described the area as one of expansive grasslands with forested areas confined to the slopes of the escarpments and along the winding courses of rivers and streams.

Kenneth Mackenzie, a lawyer and amateur botanist in the Kansas City area, and his friend Benjamin Bush, postmaster and amateur botanist in Independence, Missouri, provided the first modern description of the flora in the Jackson County vicinity. While, admittedly, the area had

undergone substantial settlement by that time, Mackenzie and Bush provided an excellent volume of information concerning the plant species present in the area, their distribution and, to a lesser extent, their abundance. Their accounting, in short, provides a sound basis upon which one familiar with the vegetation of central North America might reconstruct a picture of the potential vegetation of the Little Blue River vicinity.

Steyermark's (1963) Flora of Missouri provides an updating of the list of plants that occur in Jackson County but actually does little to aid in critically describing the area's vegetation either today or in the recent past.

Most recently, Brown and Baumler (1976) attempted to reconstruct the vegetation of the Little Blue River vicinity based on U.S. Government Land Survey Records and past botanical reports. Unfortunately, their apparent lack of botanical training resulted in a less than satisfactory account. Herbs were reported as trees, species not known to occur in the area were attributed to it, and confusing statements concerning species relations were made. Understandably, a good many of their problems may be the result of their comparison of the Little Blue River vicinity to the more eastern Little Illinois River valley where the species composition of the latter area would not be expected to fully resemble the more western area.

Jurney (1982a) constructed a relatively good vegetation map of the Little Blue vicinity, based on U.S. Government Land Survey records (Figure 7). His work essentially reflects community types similar to those as recognized by Kuchler (1964) for the region. Unfortunately, Jurney includes "important components" of the plant community which were recently (1800's) introduced (e.g., pines, locusts). These can hardly be considered reflective of the potential natural vegetation. Nonetheless, his vegetation map serves well to illustrate the location of the dominant plant communities present in the Little Blue River valley.

The most recent floristic work to include the Jackson County vicinity is the Manual of the Great Plains Flora (Barkley, Brooks, and Schofield, in press). While the work does not consider ecological relations, it, combined with the Atlas of the Flora of the Great Plains (Great Plains Flora Association, 1977), provides a modern accounting of the nomenclature and distribution of vascular plant species occurring in the area.

POTENTIAL VEGETATION

Oak-Hickory Forest

Oak-Hickory Forest occupies the areas Jurney (1982) maps as Slope-Upland Forest (Figure 7). This forest forms a zone along the slopes lying between the upland prairies and the river floodplain. In pre-settlement times these forests were kept from entering the upland

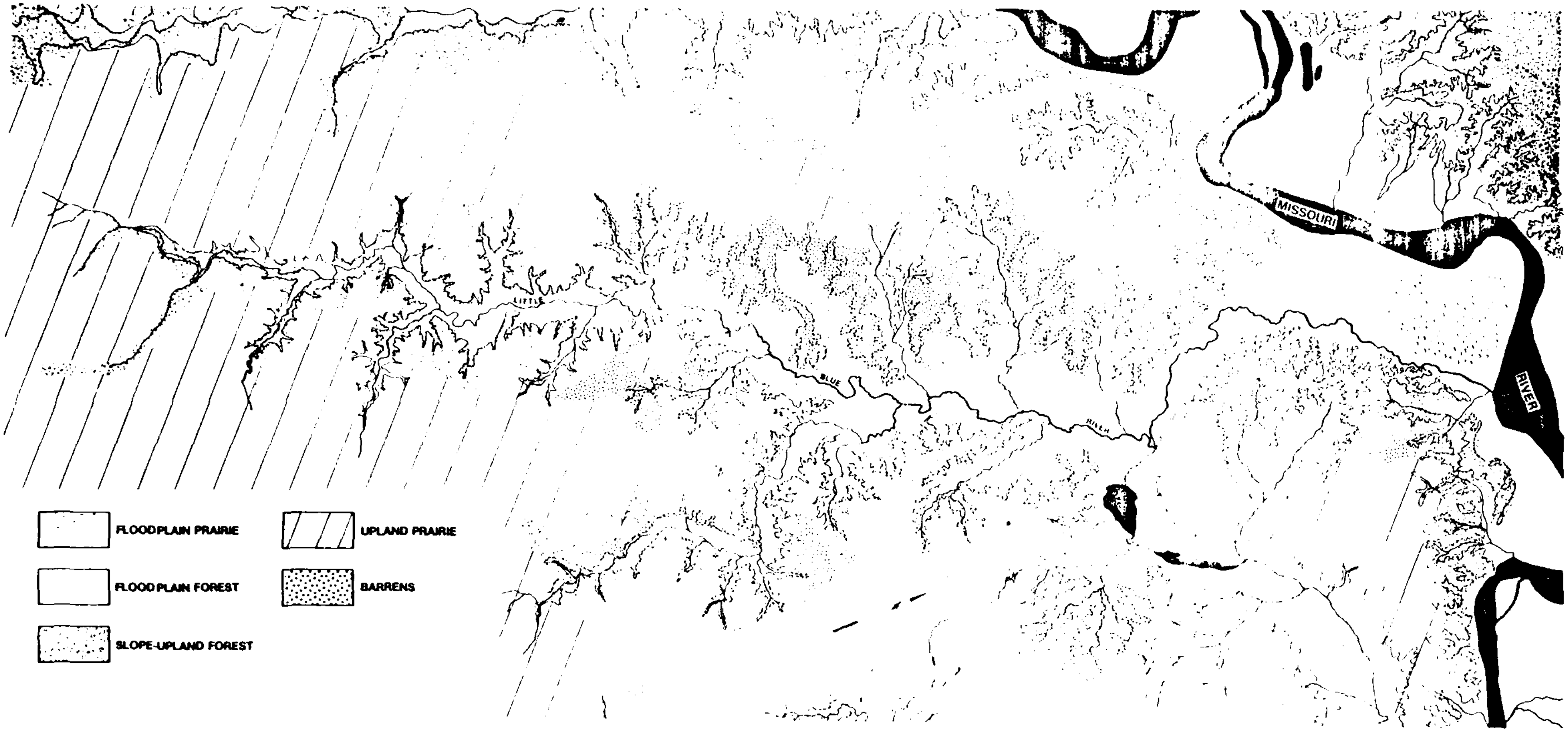


Figure 7. Vegetational communities of the Little Blue River Valley. Based on 1826 U.S. General Land Office surveys.

prairies by uncontrolled prairie fires that occurred periodically as a result of natural phenomenon or were set purposely by inhabitants of the region. The Oak-Hickory Forest did not enter the lowlands because the majority of the plants could not tolerate periodic flooding that frequently occurred.

The Oak-Hickory Forest is dominated by only a few large trees, although specimen individuals of several additional kinds occur (Table 3). The nut-bearing species flower in the very early spring but their fruit does not ripen until fall. Fortunately for gatherers of such edibles such as acorns, some degree of fruit set is achieved every year making their seasonal availability fairly predictable. Woody vines such as the grapes are present but not as abundant as in the floodplain.

Table 3. Plant species common to the Oak-Hickory Forest in the Little Blue River valley with season of fruit availability indicated.

CANOPY SPECIES:	
Major Components	
Carya cordiformis, bitternut hickory	fall
Carya ovata, shagbark hickory	fall
Celtis occidentalis, hackberry	fall
Quercus alba, white oak	fall
Quercus borealis, northern red oak	fall
Quercus muhlenbergii, chinquapin oak	fall
Minor Components	
Acer saccharum, sugar maple	fall
Fraxinus americana, white ash	summer
Juniperus virginiana, red cedar	fall
Prunus serotina, wild cherry	summer
Quercus velutina, black oak	fall
Tilia americana, basswood	summer
UNDERSTORY SPECIES:	
Small Trees	
Aesculus glabra, Ohio buckeye	fall
Asimina triloba, pawpaw	fall
Cercis canadensis, redbud	summer
Crataegus mollis, hawthorne	fall
Ostrya virginiana, ironwood	late spring

continued

Table 3 continued. Plant species common to the Oak-Hickory Forest in the Little Blue River valley with season of fruit availability indicated.

Shrubs	
Ribes missouriense, Missouri gooseberry	summer
Staphylea trifolia, bladderpod	summer
Symphoricarpos orbiculatus, buckbrush	fall
Vines	
Parthenocissus quinquefolia, Virginia creeper	fall
Smilax hispida, bristly greenbriar	fall
Toxicodendron radicans, poison ivy	fall
Herbs	
Aquilegia canadensis, columbine	summer
Arisaema triphyllum, Jack-in-the-pulpit	summer
Asarum canadense, wild ginger	spring
Aster drummondii, Drummond aster	fall
Cacalia atriplicifolia, pale Indian plantain	summer
Dentaria laciniata, toothwort	spring
Desmodium glutinosum large-flowered tickflower	fall
Erythronium albidum, dogtooth violet	spring
Geum canadense, white avens	summer
Phlox divaricata, woodland phlox	spring
Podophyllum peltatum, may apple	spring
Sanguinaria canadensis, bloodroot	spring
Sanicula gregaria, cluster sanicle	summer
Scrophularia marilandica, Maryland figwort	fall
Solidago ulmifolia, elmleaf goldenrod	fall

The herbaceous flora is somewhat depauperate as compared to that found in similar forests to the east in North America. This is primarily a result of decreased moisture availability which has prevented the western migration of species into the region. Primary growth of the herbaceous flora occurs during two distinct periods during the growing season. The first and most obvious occurs early with warming temperatures and the return of spring rains. Most of the species (Table 3) flower early and by the spring have set fruit and all but disappeared from the forest floor. For a second group of plants growth proceeds slowly until August when a second, less noticeable blooming period occurs. For these plants (including, e.g., asters, goldenrods) fruit set occurs slowly with the onset of fall.

Perhaps the most interesting feature associated with the

Oak-Hickory Forest is the suture zone which occurs between it and the upland prairies. Here the forest invades prairie areas during wet periods and retreats during dry periods. In the past, periodic fires have limited forest expansion and made conditions more favorable for prairie plant development. In this zone brushy growth of Cornus drummondii (roughleaf dogwood), Rhus aromatica (aromatic sumac), and Rhus glabra (smooth sumac) occur. Spring flowering herbs are few, while late summer flowering species are prevalent, including species such as Helianthus tuberosus (Jerusalem artichoke), Solidago canadensis (Canada goldenrod), and Chenopodium missouriense (Missouri goosefoot), and several other species of Chenopodium.

Adjacent to the upper reaches of the forest are also oak barrens area associated with limestone outcrops. Here shallow soils and low available moisture influence species composition and plant growth. It is not uncommon to find scattered Quercus marilandica (blackjack oak) and pure stands of Rhus aromatica which are quite drought tolerant. Jurney (1982) mapped a number of such areas in his work. While many spring blooming species occur in these sites (e.g., Verbena canadensis, Canada vervain,) late season types such as Chenopodium, Opuntia macrorhiza, and the common ragweed (Ambrosia artemisiifolia) are fairly common.

Floodplain Forest

Floodplain Forest occupies the lower areas of Little Blue River valley where flooding is frequent enough to have precluded the development of lowland prairies. They are dominated by rapidly growing species such as cottonwood, elm and black walnut. Flooding prevents development of much of early spring flora which is found in the Oak-Hickory Forest, and consisting mostly of a few species of grasses (e.g., Elymus virginicus, Virginia wild rye) and sedges (e.g., Carex). Extensive stands of the perennial semi-evergreen Equisetum hyemale (scouring rush) were likely present but the herbaceous flora is not truely evident until mid-summer. At that time large stands of a few species can be readily observed (Table 4), the most common including Urtica dioica, Impatiens capensis, and Ambrosia trifida.

Table 4. Plant species common to the Floodplain Forest in the Little Blue River valley with season of fruit availability indicated.

CANOPY SPECIES:	
Acer saccharinum (silver maple)	spring
Acer negundo (box elder)	spring
Fraxinus pennsylvanica (green ash)	summer
Gymnocladus dioica (Kentucky coffee tree)	fall
Juglans nigra (black walnut)	fall
Platanus occidentalis (sycamore)	fall

continued

Table 4 continued. Plant species common to the Floodplain Forest in the Little Blue River valley with season of fruit availability indicated.

Populus deltoides (cottonwood)	spring
Salix nigra (black willow)	spring
Ulmus americana (American elm)	spring
UNDERSTORY SPECIES:	
Woody Vines	
Ampelopsis cordata (raccoon grape)	summer
Parthenocissus quinquefolia (Virginia creeper)	fall
Toxicodendron radicans (poison ivy)	fall
Vitis riparia (riverbank grape)	summer
Herbs	
Boehmeria cylindrica (bog hemp)	summer
Equisetum hyemale (scouring rush)	-----
Humulus lupulus (hops)	fall
Impatiens capensis (jewellweed)	summer
Phytolacca americana (pokeweed)	summer
Urtica dioica (nettle)	summer

Along the banks of the river the canopy is frequently more open and composed of willows and cottonwood. The bars that result from lowered water levels in mid and late summer provide unique habitat for a host of annual herbs (Table 5) that go to seed in late summer and fall.

Table 5. Plants common to riverbank and bar areas in the Little Blue River vicinity with season of fruit availability indicated.

Trees	
Populus deltoides (cottonwood)	spring
Salix nigra (black willow)	spring
Shrubs	
Salix interior (sandbar willow)	spring

continued

Table 5. continued. Plants common to riverbank and bar areas in the Little Blue River vicinity with season of fruit availability indicated.

Herbs	
Amaranthus rudis (water hemp)	fall
Ammannia robusta (ammannia)	fall
Bidens polylepis (beggar's-tick)	fall
Chenopodium glaucum (oak-leaved goosefoot)	fall
Mollugo verticillata (carpetweed)	summer
Polygonum lapathifolium (pale smartweed)	fall
Polygonum pensylvanicum (Pensylvania smartweed)	fall
Portulaca mundula (purslane)	fall
Portulaca oleracea (common purslane)	fall
Rorippa palustris (bog yellow cress)	fall
Rorippa sessiliflora (stalkless yellow cress)	fall
Rumex altissimus (pale dock)	summer
Rumex crispus (curly dock)	summer

Bluestem Prairie

The Bluestem Prairie is a warm season grassland in which most of the dominant grasses mature in late summer. The remaining flora is composed of numerous grasses and forbs that flower in the spring before the tallgrass species assert themselves or in late summer and fall with the dominant grass species. A lesser peak of blooming activity occurs through the mid-season for some species.

Bluestem prairie in the Little Blue River vicinity occurs away from the escarpments on uplands where the soil is deeper and on rich valley soils where flooding is infrequent enough to allow bluestream prairie development. Unfortunately, today most of these latter areas have been claimed as prime agricultural land or for industrial development. While the upland and lowland prairie share many components, each has its own unique species, too. More importantly, however, is the difference that is seen in the abundance of certain shared species as will be discussed further on.

Both the upland and lowland prairie have today undergone encroachment from neighboring woodlands. The primary cause of this is man's activities in the region since the 1800's which have limited in the effect of fire. Without fires to check new woodland development, many areas that once existed as prairie are now in various successional stages of woodland development. Lowland areas within border woodlands often reveal a preponderance of typical prairie species. While such fluctuations undoubtedly occurred during the past 5000 years due to minor climatic shifts, the forest encroachment of the past 150 years is

likely quite dramatic in comparison to most others.

Upland Prairies

The drier, well-drained soils of the uplands are dominated by a thick cover of big bluestem, Indiangrass, and switchgrass (Table 6); all maturing late in the growing season.

Table 6. Plants common to the upland prairies in the vicinity of the Little Blue River valley with season of fruit availability indicated.

Grasses	
Dominants:	
Andropogon gerardii (big bluestem)	fall
Andropogon scoparius (little bluestem)	fall
Panicum virgatum (switchgrass)	fall
Sorghastrum nutans (Indiangrass)	fall
Other species present:	
Elymus canadensis (Canada wild rye)	summer
Koeleria pyramidata (Junegrass)	summer
Stipa spartea (needlegrass)	spring
Forbs	
Amorpha canescens (lead plant)	summer
Antennaria plantaginifolia (pussey's-toes)	spring
Artemisia ludoviciana (sage mugwort)	fall
Asclepias tuberosus (butterfly milkweed)	summer
Asclepias viridis (green milkweed)	summer
Calcalia tuberosa (tuberous indian plantain)	summer
Dalea multiflora (many-flowered prairie clover)	summer
Dalea purpurea (purple prairie clover)	summer
Desmanthus illinoensis (Illinois bundleflower)	summer
Erythronium mesochoreum (dogtooth violet)	spring
Euphorbia corollata (flowering spurge)	summer
Kuhnia eupatorioides (false boneset)	fall
Lespedeza capitata (bush clover)	fall
Liatris pycnostachya (Kansas gayfeather)	fall
Psoralea tenuiflora (scurf pea)	summer
Pycanthemum tenuifolium (mountain mint)	summer
Rosa arkansana (wild prairie rose)	summer
Rudbeckia hirta (blackeyed susan)	summer
Silphium laciniatum (compass plant)	fall
Sisyrinchium campestre (blue-eye grass)	spring
Solidago rigida (stiff goldenrod)	fall
Viola pedatifida (bird's foot violet)	spring

Spring blooming activity begins in the upland prairie in late March or early April with dogtooth violet, pussy's-toes, and a small sedge, Carex microrhyncha, being the first to appear. Soon after, the prairies turn to a sea of color with legumes, composites, and a host of other spring flowering grasses and forbs (Table 6). The majority of these species set fruit quickly by late spring, and die back to the ground or soon disappear beneath the warm season grasses that by June have begun to grow more rapidly.

The increased heat and reduced rainfall of the mid-summer is obviously a detriment to most species in the prairie. The numbers of plants flowering through mid-season are minimal compared to the spring and fall periods. Some of the more obvious species include Illinois bundleflower (Desmanthus illinoensis), prairie clover (Dalea tenuiflora) and blackeyed susan (Rudbeckia hirta).

By August many of the larger forbs and tall grasses have begun to flower. This starts a second peak blooming period in the prairie and in essence is a signaling that the season's end is not far away. Some of the more common species found at this time include Kansas gayfeather, compass plant, and flowering spurge, as well as others listed in Table 6. Many of these species flower late into the fall and their fruit mature near the time of the first frost.

Lowland Prairies

Flowering periodicity in the lowland prairies is similar to that occurring in the upland prairie with a distinct spring and late summer peak and a lesser one through the mid-season. The rich valley soils support dense grass cover of big bluestem mixed with small numbers of Indiangrass and switchgrass. Little bluestem is usually not common, as it prefers drier habitats. Extensive colonies of the rhizomatous cordgrass and eastern gamagrass are a common sight here.

Widely scattered among the grasses are individuals of the woody lead plant and a host of herbaceous species, with some of the more common species listed in Table 7. Plants flowering in late spring and summer are more common in the lowland prairie than in the upland probably due to the greater moisture availability. Examples of these include the now rare Michigan lily and bunchflower.

In the lowest areas of the prairie the ground is sometimes so water saturated that open areas occur between the clumps of vegetation. Semi-aquatic plants such as certain species of Carex, Scirpus, Eleocharis, or Cyperus are usually common. Frequently, too, these areas are marked by the occurrance of thickets of false indigo and elderberry or by scattered individuals of buttonbush.

Table 7. Plant species common to the lowland prairies in the vicinity of the Little Blue River valley with season of fruit availability indicated.

Graminoids	
Dominant Grasses:	
Andropogon gerardii, big bluestem	fall
Sorghastrum nutans, Indiangrass	fall
Spartina pectinata, cordgrass	fall
Tripsacum dactyloides, eastern gamagrass	summer
Other species present:	
Andropogon scoparius, little bluestem	fall
Carex spp., sedges	spring
Eleocharis spp., spike sedges	spring
Juncus dudleyi, Dudley's rush	summer
Juncus tenuis, rush	summer
Panicum dichotomiflorum, fall panicum	fall
Panicum virgatum, switchgrass	fall
Scirpus pendulus, rusty bulrush	summer
Forbs	
Camassia scilloides, wild hyacinth	spring
Desmodium canadense, Canada tick clover	fall
Helianthus grosseserratus, sawtooth sunflower	fall
Hypoxis hirsuta, golden stargrass	spring
Lilium canadense, Michigan lily	summer
Lysimachia ciliata, fringed loosestrife	summer
Melanthium virginicum, bunchflower	summer
Oelnothera biennis, evening primrose	fall
Sisyrinchium angustifolium, blue eye grass	spring
Sisyrinchium campestre, blue-eye grass	spring
Silphium perfoliatum, cup plant	fall
Solidago canadensis, Canada goldenrod	fall
Verbena hastata, blue vervain	fall
Shrubs	
Amorpha fruticosa, false indigo	fall
Cephalanthus occidentalis, buttonbush	fall
Sambucus canadensis, elderberry	summer

Aquatic Communities

Natural lakes were evidently not present in the Little Blue vicinity prior to recent settlement. Consequently, aquatic plant communities were limited to oxbow and backwater areas along the stream and river courses present at that time. These shallow water habitats generally supported large, nearly pure stands of cat tails (*Typha angustifolia*, *T. latifolia*) or bulrush (*Scirpus fluviatilis*, *S. validus*). In the shallowest areas were various arrowheads (*Sagittaria* sp.), mud plantains (*Alisma* sp.), and primroses (*Lugwigia* sp.). In time many of the backwater marshy areas likely filled with decaying plant material to the point that they could not be distinguished from the wetter prairie sites.

Strict aquatics such as pondweeds (*Potamogeton* sp.) were probably not common in the area since these plants, in the Little Blue area our area at least, require permanent standing water for growth. Flowing water or water that is disturbed by wave action creates unfavorable growing conditions for these species.

CHAPTER IV

LATE QUATERNARY BIOCLIMATIC CHANGE IN WESTERN MISSOURI

Rolfe D. Mandel

The Little Blue drainage basin is situated in a border area between two major biomes, the oak-hickory forest to the east and the bluestem prairie to the west. This border area, or ecotone is a mosaic of the two biomes. The paleobotanical evidence indicates that the prairie-forest ecotone has constantly shifted through time. Joyer (1981) points out that the fluctuation of this ecotone in Missouri has been of a quantitative nature rather than qualitative. That is, the same particular plant species have probably made up each environmental zone since the end of the Pleistocene, but the sizes of the zones have fluctuated due to climatic changes during the Late Quaternary. The nature of these climatic changes and their effects on vegetation are considered in the following discussion.

As noted in Chapter I, the Little Blue drainage basin lies along the southern boundary of the Prairie Peninsula. This wedge-shaped midcontinent area of tall grass prairie is characterized by low winter rainfall and snowfall, and occasional summer droughts that have a large impact on ecotones. Both the northern and southern margins of the Prairie Peninsula appear to coincide generally with marked climatic gradients. According to Borchert (1950), the southern margin coincides with the mean position of the winter storm track, which is the northern edge of maritime tropical air. Bryson (1966) associated the prairie-forest boundary with the mean winter position of the Pacific frontal zone (Figure 8). Bryson's airmass model relates the North American prairie grassland region to the area covered by relatively dry Pacific air during the winter months. According to this model, when Pacific airstreams move persistently eastward, the prairie expands at the expense of forest under conditions of desiccation. Although this air is initially cool and moist, it loses much of its moisture on the windward side of the Rocky Mountains, and is adiabatically warmed as it descends the mountains. As this warm air spreads out across the Plains, it has a desiccating effect on the vegetation, causing the Prairie Peninsula to expand. Conversely, when Pacific air is less frequent, the prairie experiences increased moisture from the Gulf of Mexico and, consequently, diminishes in size as trees invade the previously dry region. Davis (1977) pointed out that moisture stress appears to be the major climatic constraint influencing the location of the prairie-forest ecotone. He also notes that the northeast-southwest moisture stress gradient has a north-south temperature gradient superimposed on it.

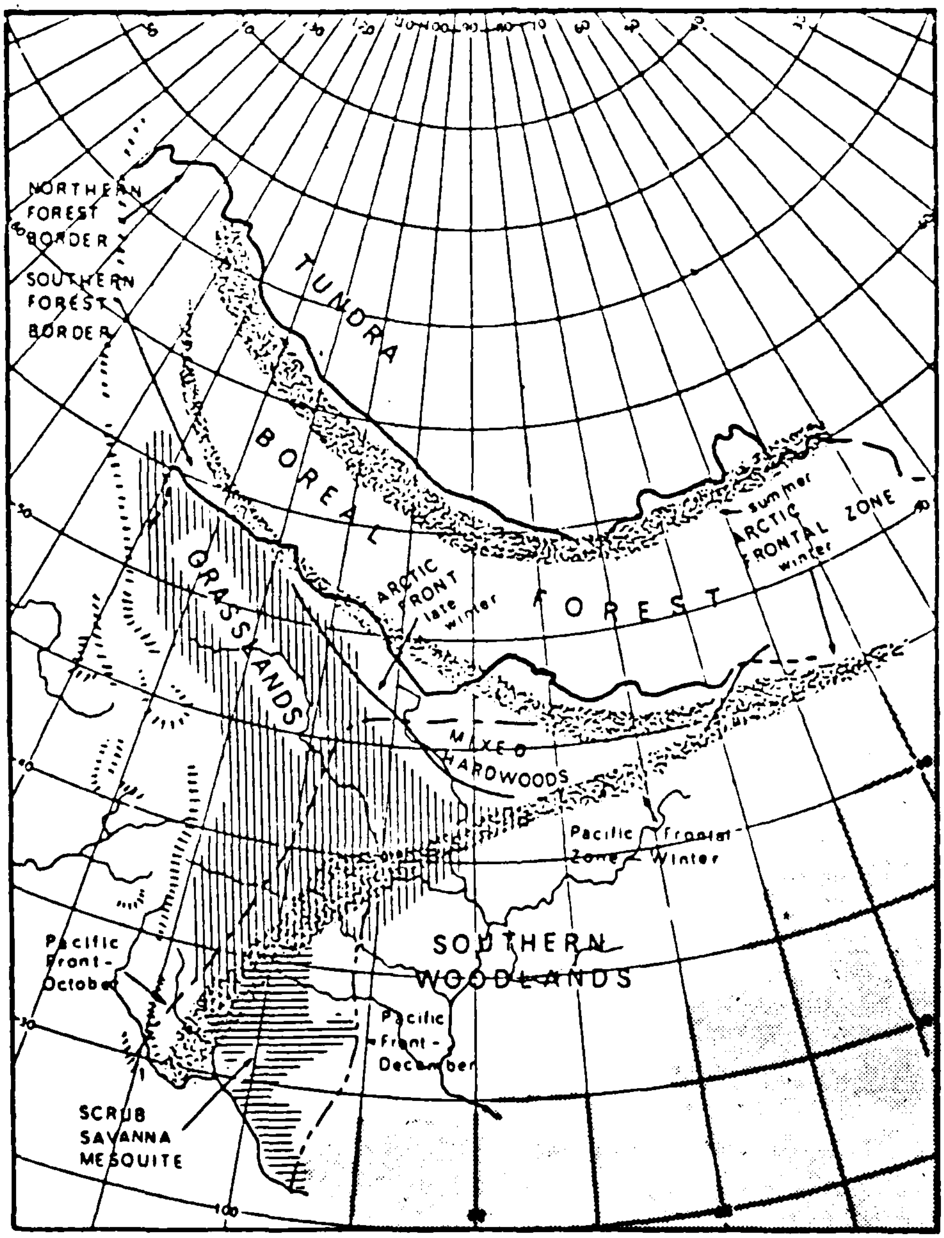


Figure 8. The coincidence of biotic regions with meteorologically defined climatic regions (from Bryson, Baerreis, and Wendland, 1970).

Bioclimatic changes along the southern margin of the Prairie Peninsula during the late Pleistocene and Holocene are documented by several palynological studies (e.g., Wright 1976; Gruger 1973; King and Lindsay 1976; King and Allen 1977; Van Zant 1979). The floral and faunal records from spring deposits in the area of Rodgers Shelter (King and Lindsay 1976) indicate that an open pine parkland existed in the western Missouri Ozarks from at least 34,000 to about 24,000 years ago. With the onset of full-glacial climatic conditions around 23,000 to 24,000 years ago, spruce forest replaced the pine parkland. Spruce was present from this time until at least 13,500 B.P., although it declined in dominance near the end of the Wisconsin glacial episode. According to King and Lindsay (1976:77), spruce disappeared from the Ozark Highland about 12,000 years ago.

The pollen evidence indicates that by ca. 16,000 B.P. climatic warming had progressed sufficiently to cause a reduction in the number of spruce trees in western Missouri, south of glacial maximum, and thermophilous deciduous trees such as oak (Quercus), hickory (Carya), ash (Fraxinus), hop hornbeam/hornbeam (Ostrya/carpinus), and maple (Acer) started to replace the spruce (King 1980:4). Pollen data from Muscotah Marsh (Gruger 1973), located about 75 km west of the Little Blue valley, show spruce forest being replaced by deciduous forest with prairie elements sometime between 15,000 and 11,340 B.P. King (1973) suggested that the transition from glacial to post-glacial vegetation occurred about 12,000 years ago in the Kansas/Missouri border region. Prairie spread eastward across Iowa and Missouri, reaching its maximum extent between about 7000 and 6400 B.P. (Bernabo and Webb 1977; Baker and Van Zant 1980), implying maximum Holocene aridity and/or temperature at this time in the eastern Great Plains.

A mid-Holocene period of warm temperatures and low precipitation has been postulated for most of North America. Deevey and Flint (1957) introduced the term Hypsithermal to designate this period of high post-glacial temperature. More recently, Baerreis and Bryson (1965a, 1965b) referred to the Hypsithermal as the Atlantic climatic episode. Since the time when these terms were originally defined, this climatic interpretation has been broadly supported by pollen analyses (e.g., Muscotah Marsh, Gruger 1973; Woden Bog, Durkee 1971; McCollogh Bog, Brush 1967; and the Old Field site, King and Allen 1977), and can be explained by hypothesizing changes to Bryson's (1966) airmass model. Although Deevey (1969) suggested that the pollen sequences might be attributed to human influence, i.e. anthropogenic fires, any doubt that climatic change is the primary environmental factor responsible for the fluctuation of the prairie-forest border is eliminated by paleolimnological evidence from the northern border of the Prairie Peninsula. Of particular significance is the finding that seeds of weedy wet ground plants are conspicuous at several sites in lacustrine sediments representing the prairie period (Watts and Winter 1966; Watts and Bright 1968; Wright 1976). Wright (1976) suggested that lakes in western Minnesota dried up periodically during this time (Hypsithermal), allowing the temporary expansion of weedy plants over the coring sites. He noted that the abundance of seeds of aquatic plants at other levels in the sediments suggests a pattern of periodic drought, perhaps similar to those that occurred in modern times at the prairie border (e.g., the

1930s). The seed studies are supplemented at one site by profiles of diatoms (Haworth 1972), mollusks (Watts and Bright 1968) and the oxygen-isotope ratios of mollusk shells (Stuiver 1970), which all indicate increased salinity at the time of maximum prairie development. Altogether, the case for a mid-Holocene interval of warm, dry climate on the northern flank of the prairie peninsula is substantial enough that it can serve as a standard against which other regions can be compared (Wright 1976).

The pollen record from Muscotah Marsh clearly indicates a mid-Holocene episode of dry climatic conditions for the Kansas/Missouri border region. This record shows that by about 9900 B.P. there was an increase in Ambrosia and Franseria pollen and a decrease in the percentage of arboreal pollen. Gruger (1973:248) suggested that the increase in ragweed marks the beginning of the prairie period. Prairie dominates at Muscotah Marsh until 5100 B.P. when the pollen indicates renewed development of oak-hickory woodland and a return to a more mesic climate.

With the beginning of the late Holocene (ca. 5000-4000 B.P.) much of the midcontinent experienced a general relief from hot and dry conditions (Webb and Bryson 1972:108). The westerlies diminished and midwestern climates became relatively stable (Wright 1976). Forests expanded at the expense of grasslands as the prairie-forest ecotone in Missouri migrated to the north and west. King (1977:14) suggested that the late Holocene climate has been "...a climatic regime of its own, wetter than the dry period that preceeded it but not as wet as the early Holocene". Although the major trend of increased precipitation characterizes the late Holocene, numerous minor climatic changes have been discussed in the literature. For example, Swain's (1978) study of pollen and macrofossils from Hell's kitchen, north-central Wisconsin, implies that three "moist" intervals and at least one "dry" interval occurred within the last 2000 years. Denton and Karlen (1973) suggested that there have been several minor intervals of glacial expansion followed by "warm" intervals of glacial recession during the last 5000 years. Others (e.g., Baerreis and Bryson 1965; Bryson 1965; Bryson and Wendland 1969; Bryson et al. 1970; Wendland and Bryson 1974) have outlined a series of as many as seven climatic episodes for the last 5000 years, based upon the Blytt-Sernander sequence.

Episodic fluctuations in climate during the late Holocene probably resulted in periodic shifts of the prairie-forest ecotone. Reeder and others (1983:49) suggested that while there were minor shifts in the position of the prairie/forest border, the biome distribution remained relatively stable. Others have suggested continual movement of the ecotone throughout the late Holocene, even during the last 2,000 years. King (1977:14) remarked:

> Throughout the late Holocene continued climatic shifts have caused slow forest encroachment into prairie, and the pollen evidence suggests that forest encroachment was still going on when European settlement started.

Ruhe (1974:487) also noted that during the past few thousand years climatic changes have caused"... encroachment of forest on prairie resulting in the formation of transitional or integrade soils".

Geomorphological and paleoecological evidence suggests that the landscape and biotic communities in central Missouri were relatively stable at 5000 B.P. (Reeder et al. 1983; Haynes 1981). During the Sub-Boreal climatic episode (5000-2760 years B.P.) temperatures remained warm over much of the United States, but precipitation increased. Wright (1976:590) suggested that the trend in increasing moisture was gradual and continuous without long, distinctive breaks in the climate pattern. However, Bryson and others (1970) contend that this period may have been marked by periodic fluctuations between warmer and drier conditions and cooler, moister periods. Stream entrenchment in many areas of the East-Central Plains suggests a humid climate during the Sub-Boreal episode (Brakenridge 1981; Haynes 1981; Thompson and Bettis 1980; Schmits 1980; Johnson 1977). A time-transgressive replacement of xeric by more mesic plant taxa began around 5000-4000 B.P. with biome distributions stabilizing around 3000 B. P. (Reeder et al. 1983:48). In Missouri, deciduous forest replaced prairie on slopes and bottomlands, but many upland areas remained either in prairie or in barrens or savanna (Reeder et al. 1983).

There is little evidence from the East Central Plains indicating major climatic changes during the late Holocene. However, the few studies which provide such evidence all indicate an episode of increased moisture from ca. 3000 to at least 2000 years B.P. At the Coffey site on the Big Blue River in northeastern Kansas, Schmits (1980:102) found that a paleochannel of the river, probably formed around 2500 B.P., was only 95 m wide, compared to the 140 m width of the nineteenth century channel. He suggested that the narrow paleochannel represents a former deep, sinuous stream, in contrast to the wide, straight channel of historic time. The paleochannel was probably formed by streamflow dominated by frequent floods of moderate magnitude.

At Rodgers Shelter, on the Pomme de Terre River in western Missouri, an episode of intense upland erosion, indicated by an accumulation of coarse alluvial fan gravels, ended at 3000 B.P., and was followed by the deposition of fine-grained colluvium from 3000 to 1750 B.P. Ahler (1976:137) interpreted the transition at 3000 B.P. as reflecting the recovery of vegetation with increased moisture, following an episode of relative aridity.

Klippel and others (1978), studying mollusks from archaeological strata at Rodgers Shelter, supported Ahler's inference. They found that the predominant mussel species from Early and Middle Archaic layers at the shelter (8600-3000 B.P.) reflected shallow, low discharge stream habitats. Mussels from Late Archaic and Woodland layers (3000-1750 years B.P.) reflected deeper, larger streams (Klippel et al. 1978:265-268), indicating increased streamflow during this interval.

The 3000-1750 B.P. interval of increased streamflow on the Pomme de Terre River includes the T1b4 aggradation episode identified by Brakenridge (1981), suggesting the correlation of geomorphic response

with climate change. There is no sedimentological or biotic evidence for climatic change after 1750 B.P. at Rodgers Shelter.

Around 2600-2700 years ago, a period of increased deposition occurred at Ferndale Bog in southeastern Oklahoma, probably due to wetter conditions which caused rapid peat growth and some influx of sediments from uplands (Albert 1981:99). This seems to correspond with the erosional episode in the Pomme de Terre Valley dating to about 3000 B.P.

According to Bryson and Wendland (1968; 1970:64-70), it was not until the Pacific episode (ca. 950-450 B.P.) that another significant climatic reversal took place - one that is documented by a vegetational discontinuity in the pollen record. They pointed out that the pollen evidence from northwestern Iowa shows a change from tall grass prairie and gallery forest to steppe at about A.D. 1200 (800 B.P.). Bryson and Wendland (1980:64) attribute this vegetation change to a dramatic increase in the frequency of summer droughts resulting from stronger westerly air flow across the Plains.

Studies of pollen and land snail succession from the Cross Timbers region of northeastern Oklahoma support the hypothesis of a dry Pacific episode. These studies, summarized by Hall (1982), indicate that a biota similar to the present had been established by at least 2000 B.P. The pollen record from Big Hawk shelter on Hominy Creek indicates that moisture availability increased from 1550-1350 B.P. (Hall 1980). Hall (1980:44) noted an increase in the frequency of hickory (Carya sp.) pollen from two percent at 1550 B.P. to a peak of 12 percent at 1350 B.P., followed by a gradual decline to three percent at 900 B.P. He suggested that the decrease in hickory represents a decrease in moisture availability.

The dominant trend in the land snail evidence from Big Hawk Shelter parallels the pollen profile. Snails which prefer moist habitats increased in frequency from 15 percent at ca. 1900-2000 B.P. to a peak of 35 percent at 1450-1550 B.P. The frequency of these snails decreased to five percent by 450 B.P. Coincident with the decrease in moist habitat snails and hickory was the appearance of the dry habitat snail, Triodopis craigini. Hall (1982:404) noted that the frequency of dry habitat snails increases at other rock shelters in Hominy Creek and nearby Birch Creek valley at dates ranging from 900 to 700 B.P.

The pollen and land snail evidence from northeastern Oklahoma records late Holocene changes in the relative frequency of species in an essentially modern biota. Major climatic change, causing local extirpation or replacement of species, is not indicated. Artz (1983) noted that the decrease in available moisture recorded for the period 1550-1000 years B.P. in Cross Timber's rockshelters may reflect not so much a decrease in mean annual precipitation, as an increase in variability of precipitation. This may have resulted in a greater frequency of short-term droughts. As Transeau (1935) noted, "the extremes of factors are vastly more important than the means...an extreme drought marked by lower precipitation, higher evaporation, higher temperatures, and more intensive light can change vegetation more

in a few years than a century of favorable weather conditions".

The warm, dry Pacific episode postulated by Bryson and Wendland (1968, 1970) reached a climax in western Michigan between 1000 A.D. and 1200 A.D. (Bernabo 1981:153), and ameliorating conditions began soon afterwards in the northern and eastern United States (Reeder et al. 1983:451). This change marks the beginning of the Neo-Boreal climatic episode (400-130 B.P.).

The cool and moist conditions of the Neo-Boreal, or Little Ice Age, peaked in the Midwest between 350 and 200 B.P. (Swain 1978; Fritts et al. 1979; Bernabo 1981). During this period forests expanded into grasslands by moving up watercourses and steep slopes onto level upland areas (Geis and Boggess 1968). The General Land Office (GLO) records indicate that the Neo-Boreal prairie-forest boundary in Missouri expanded north and west into upland prairie. Warren and others (1982:38) suggested that climatic warming after A.D. 1850 would have reversed the expansion of forests, had Euro-American settlement not seriously disturbed native plant communities and controlled fire during the 19th and 20th centuries.

Evidence from land surveys indicates that at the period of Euro-American settlement, the oak-hickory forest was invading the grassland near Rodgers Shelter in western Missouri (King and Lindsay 1976). King and Lindsay (1976) suggested that the areas described as "barrens" were sections of the broad border between the Ozark forests and the Prairie Peninsula where arboreal species were invading the grassland. They suggested that this trend has continued to the present, except for temporary reversals during drought years such as those of the 1930s.

SUMMARY AND CONCLUSION

Paleobiotic and geomorphic evidence presented in the preceeding discussion suggests that there have been major climatic changes along the southeastern periphery of the Central Plains. This evidence also suggests that the prairie-forest ecotone in the Midwest has shifted in response to the fluctuating climate. Borchert (1950) and Bryson (1966) associated changes in the position of the ecotone with meteorological mechanisms which underlie the climate of the Central Plains. They have shown that the prairie of central North America is occupied by a wedge of air, dried by subsidence on crossing the Rockies, which is driven far eastward by the westerlies. The stronger the westerlies, the farther eastward the dry wedge should push, and with it the associated biota. This bioclimatic model, which involves shifting dominance of air masses over the grasslands in response to strengthened or weakened westerly flow, has provided succinct climatological explanations for Late Pleistocene and Holocene biogeomorphic shifts at the margins of several North American biomes, including the prairie-forest ecotone in western Missouri.

The pollen record indicates that an open pine parkland existed in the western Missouri Ozarks from ca. 34,000 to about 24,000 years B.P.

The pine parkland was replaced by spruce forest as full-glacial climatic conditions were established around 23,000 years ago. Spruce forest was present in western Missouri from this time until at least 13,500 B.P. Beginning around 13,000 B.P., post-glacial warning caused prairie to spread eastward from the Central Plains into Missouri. Pollen and faunal data suggest that this trend peaked between 7000 and 6400 years B.P., although it probably continued for another millennia. This "prairie period" corresponds to the Hypsithermal - an episode of maximum Holocene aridity in the eastern Great Plains.

Geomorphic and paleobiotic evidence from Rodgers Shelter in western Missouri points to a complete recovery of arboreal vegetation with increased moisture around 3000 B.P. Studies of pollen and land snail succession from areas along the southeastern margin of the Plains indicate that a biota similar to the present had been established by at least 2000 B.P. There is no evidence for major bioclimatic change after ca. 1750 B.P. in western Missouri. However, mollusk and pollen records indicate that there have been vegetational perturbations in response to episodes of drought during the late Holocene. Since droughts tend to favor grasses over arboreal species, ther is a tendency for the prairie-forest border to shift in response to long-term and short-term fluctuations in the availability of moisture.

The Pacific climatic episode (ca. 950-450 B.P.) was characterized by warm, dry conditions. Pollen evidence suggests that during this episode, grasslands attained their greatest extent since the Hypsithermal.

Among late Holocene climatic episodes, the one that deviated most from modern conditions in the East-Central Plains apparently was the Neo-Boreal (ca. 400-130 B.P.) or Little Ice Age. This was a moist and cool period that occurred between the anomalously warm Pacific (ca. 950-450) and Recent (130 B.P.-present) climatic episodes. The Neo-Boreal climate should have been favorable for the expansion of forest onto prairie in the study area.

Evidence from land surveys indicates that at the period of Euro-American settlement, the oak-hickory forest in western Missouri was invading the grasslands. The oak-hickory forest of 140 years ago had encroached on the prairie-formed soils to a considerable extent, with the ecotone well within the limits of the prairie soils. This trend has apparently continued to the present, except for temporary reversals during drought years.

Additional paleobotanical research is needed in western Missouri to fully reconstruct Holocene bioclimates. In particular, there is a need for a post-glacial pollen chronology that overlaps the geomorphic and cultural data from the Little Blue drainage basin. This information would enable us to fully understand the characteristics of the Late Quaternary environments which formed the setting for human occupation and exploitation of the area.

CHAPTER V

SITE 23JA143

Larry J. Schmits, Ed Kost and John Neas

23JA143 is a stratified Middle Woodland and Middle Archaic occupation located on the East Fork of the Little Blue River (Figure 9). This site was initially reported as a Kansas City Hopewell site by Brown (1977) and described as extending over approximately 25 acres. Testing conducted by Brown at the north end of the site just below the upland bluffs recovered cultural debris from the plow zone. Further testing at the southern end of the site along the Little Blue River encountered evidence of an intact Woodland deposit just below the plow zone. Material recovered included a hearth and a small number of artifacts. Based on the results of the 1977 work, Brown recommended further testing of the site.

The additional testing at the site was conducted by Soil Systems, Inc. in 1979 (Peterson and Schmits 1982). Work conducted at that time indicated that the site consisted of the two discrete occupational areas tested by Brown in 1977. No evidence of cultural debris was encountered between the two areas. In order to distinguish these areas, they were designated as Localities I and II with Locality I being the northern area along the bluffline and Locality II being the southern area.

The testing conducted in 1979 by Peterson and Schmits (1982) was primarily focused on Locality II. A large number of artifacts including plain surfaced grit and sand tempered body sherds and chipped stone tools were recovered from a cultural zone located at 20-40 cm below the surface. A radiocarbon date of 1620±70 years B.P. (A.D. 330) and the smooth surfaced grit or sand tempered ceramics indicated a Middle Woodland cultural affiliation for the site. Since the Middle Woodland period was relatively unknown in the Little Blue valley, Peterson and Schmits (1982) recommended mitigation consisting of either preservation or additional data recovery investigations at the site. The site, as part of the Blue Springs Archaeological District, was eligible for the National Register of Historic Places. Since the site was to be inundated by Blue Springs Lake, data recovery investigations were conducted by Environmental Systems Analysis, Inc. (ESA) in 1983-1984.

DESCRIPTION OF THE INVESTIGATIONS

The 1983 Phase III investigations at 23JA143 commenced with the clearing of high ved cover from the site area. Unfortunately, the area of the site had been disturbed by tree and brush removal the prior winter. This work had destroyed the datum placed at the site in 1979.

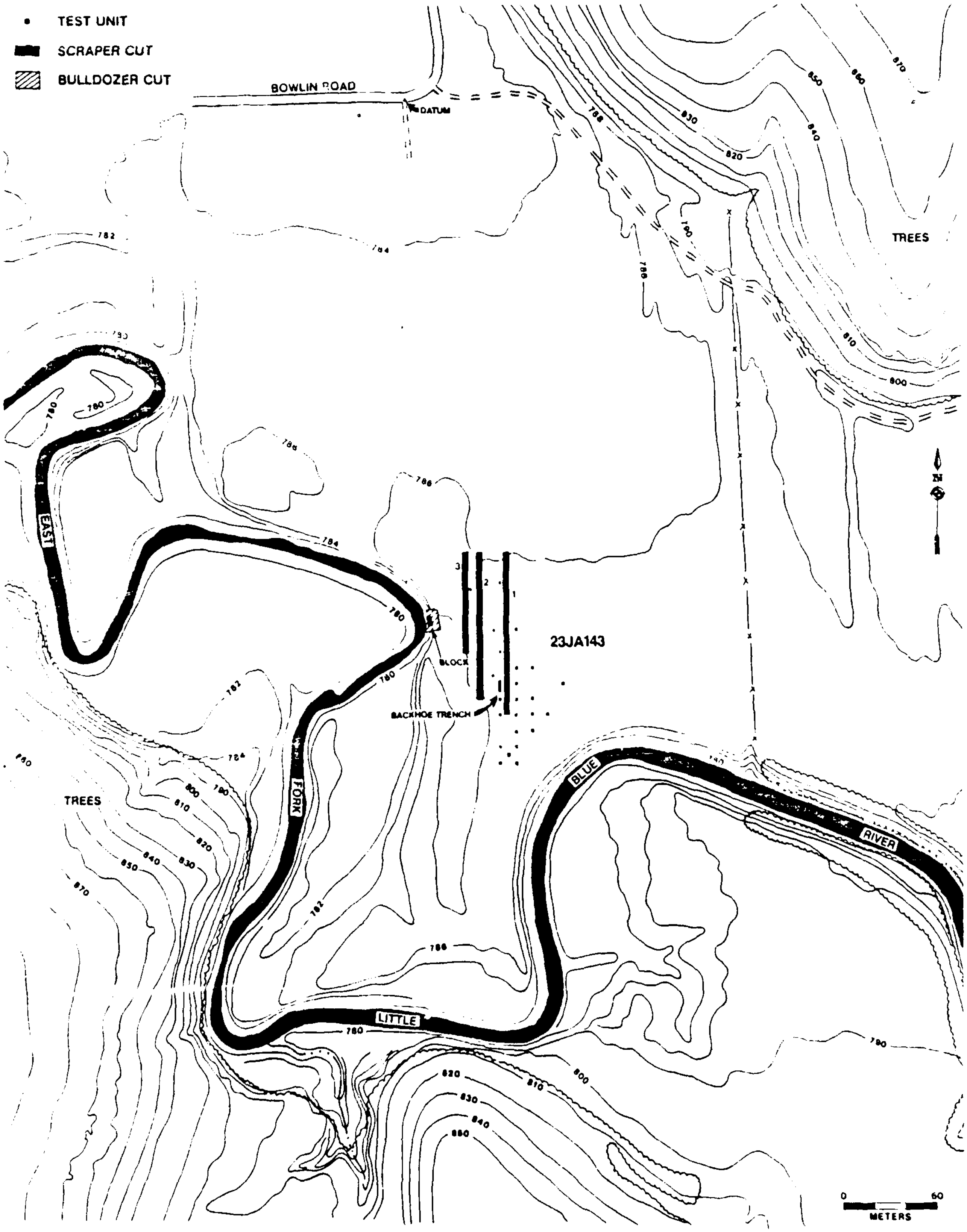


Figure 9. Plan view of the excavation at 23JA143.

Therefore, three north to south oriented transects of one by one m test units were laid out at ten meter intervals in order to relocate the site. Fifteen test units were excavated along the three transects to a depth of 60 cm below surface. The test excavations resulted in the recovery of only one flake and a side-notched dart point. Based on the negative results of the test excavations, nine additional test units were excavated at varying distances from the three transects. These excavations resulted in the recovery of an additional flake, a scraper and two burnt rocks. The artifacts were recovered from various test units and no concentration of cultural materials could be located.

Since the initial 1983 testing at 23JA143 was unable to relocate the relatively concentrated cultural deposits defined during the 1976 and 1979 investigations, a paddlewheel scraper was used to explore the site more fully. Three parallel north to south cuts, referred to as Scraper Cuts 1-3, were excavated to a depth of 60 cm below surface. Scraper Cut 1 was approximately 100 m in length, Scraper Cut 2 was approximately 90 m in length and Scraper Cut 3 was 60 m length. Excavation proceeded by removing 3-5 cm levels with each pass. The surface exposed by each successive pass was examined for the presence of artifacts and features. Except for occasional charcoal flecks and the recovery of a burnt rock from Scraper Cut 1, the mechanized excavations produced little additional evidence of the Middle Woodland component. A backhoe trench was also excavated to a depth of 2.5 m below surface in order to investigate the soil stratigraphy of the site. The walls of this trench were inspected for evidence of cultural materials; however, none were found. The 1983 excavations at 23JA143 indicated the presence of a limited amount of cultural debris. The concentrated areas of cultural deposits located by Brown in 1976 and by Peterson and Schmits in 1979 were not relocated and likely had been dissipated by the brush clearing operations.

The deeply buried Middle Archaic component at 23JA143 was discovered in November 1983 during the soil-geomorphic investigations along the cutbank to the west of 23JA143. Prior inspection of the cutbank in 1979 and 1982 had revealed occasional isolated flakes eroding from a considerable depth below the surface, however, no concentrated deposits were found. Profiling along the cutbank in November of 1983 revealed a thin zone of debitage, bone fragments, charcoal and burnt earth flecks located at a depth of 3.2-3.4 m below the surface and extending along the cutbank for a distance of 30 m. Bone and debitage appeared to be most concentrated along the southern end of the deposit. This area of the cutbank was slumped during earlier inspections but had been scoured by recent flooding exposing a clean profile.

A backhoe was used to remove the culturally sterile overburden from a small area along the river bank near the southern end of the buried deposit in order to test the buried component. A cartesian coordinate grid system was then established within the backhoe cut which paralleled the cutbank with the X axis oriented grid east and the Y axis oriented grid north. Excavation of an initial 2 by 3 m test block encountered two features, a large concentration of animal bone, chipped stone tools, debitage, charcoal and burnt clay. Feature 1 consisted of a concentration of debitage and chipped stone tools including a small

proximal section of a side-notched point. Feature 2 consisted of a hearth and an associated burnt clay and charcoal scatter. A radiocarbon date of 6660±100 years B.P. was obtained on charcoal collected from Feature 2. Due to the highly threatened nature of the cultural deposit along the cutbank, the original 2 by 3 m test block was expanded to a 2 by 6 m test block in December of 1983. These additional excavations recovered an additional small side-notched dart point, as well as a larger sample of chipped stone tools, faunal remains and lithic manufacturing debris.

The radiocarbon date and diagnostic artifacts recovered from the test excavations indicated that the buried component at 23JA143 consisted of an early Middle Archaic deposit. The test excavations also indicated that features and faunal and floral remains were preserved and that the site would produce considerable information regarding Middle Archaic chronology and settlement-subsistence patterns. Since these data were of considerable significance in terms of regional research questions, more intensive data recovery investigations were recommended for the site (Schmits et al. 1984).

Additional excavations at 23JA143 were conducted during the summer of 1984 under terms of a modification to the contract DACW41-83-C-0095. As a result of this work, the initial test block was expanded and an additional 47 square meters of the site were excavated (Figure 10). The results of the work indicated the presence of a series of features and occupational debris oriented along a north-northwest to south-southeast axis. Ten additional features were located including four debitage concentrations or chert knapping areas, four hearths and two refuse area. The southwest and northeast limits of the cultural zone were defined by the excavation. Areas of concentrated deposits appear to extend to the southeast of the excavation and to the north of the excavation along the cutbank of the Little Blue River. The profile exposed by the cutbank indicates that concentrated cultural deposits extended 6-7 meters to the north of the excavation.

The 1984 work at 23JA143 recovered an additional sample of charcoal suitable for dating and considerably expanded the sample of chipped stone tools and faunal and floral remains. Matrix samples included the entire fill of features and 5 liter samples from each excavation unit were collected for flotation.

GEOMORPHOLOGY AND SOIL STRATIGRAPHY

23JA143 is located within the T-1 terrace of the East Fork of the Little Blue River. Based on the results of the excavation, three depositional units have been defined in the T-1 deposit at the site (Figure 11). In ascending order these units have been designated as Units A-C. The soils and stratigraphy of the site have been examined by Rolfe Mandel and the following discussion is based on his work.

Unit C is a recently deposited silty alluvium which forms a levee

Figure 10. General views of the 1984 excavations at 23JA143. Overburden removal (upper) and general view of block excavation near completion (lower).

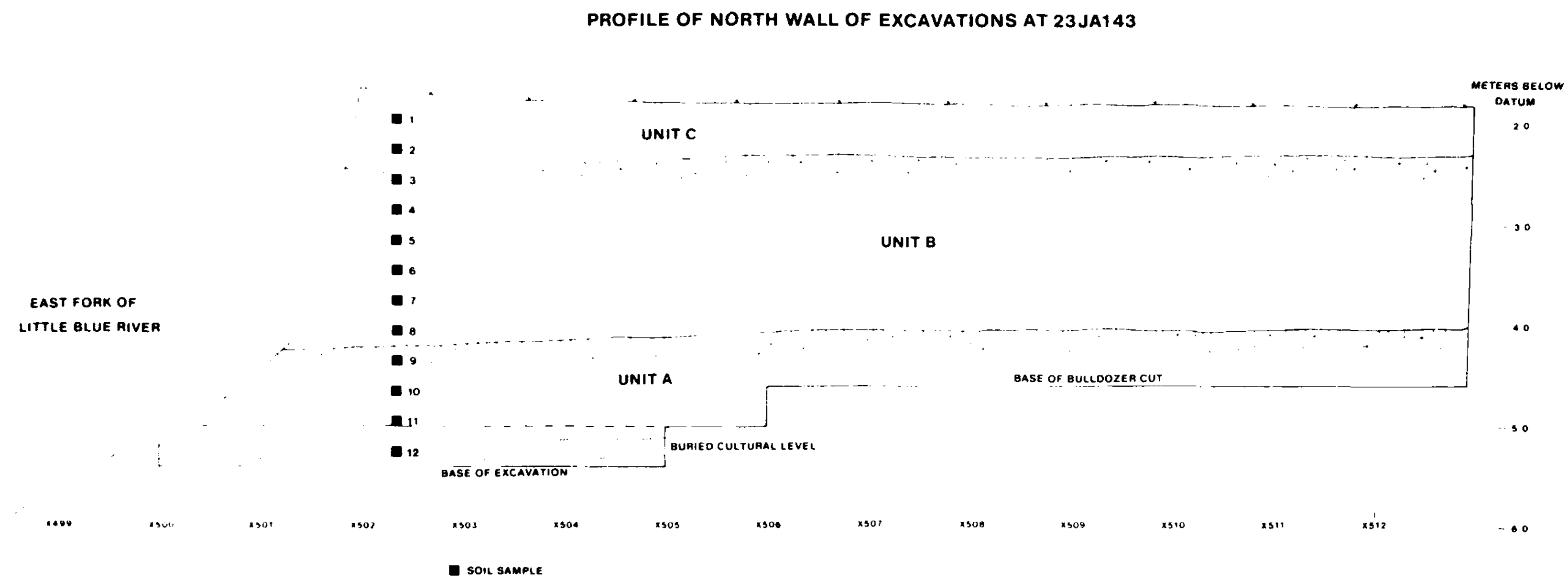


Figure 11. Profile of the north wall of the excavations at 23JA143.

on the surface of the T-1 terrace. This stratum is approximately 80 cm thick along the river bank and pinches out a short distance from the stream bank. Physical and chemical properties of Unit C are presented in Table 8. The unit has an A-C soil profile that is insufficiently developed to form a B horizon. The upper 40 cm of the profile is very dark grayish brown (10YR3/2) mollic epipedon with an organic carbon content of 3.1 percent. The lower 37 cm is a C horizon characterized by moderate organic carbon content (1.2 percent) and a fine granular structure. An abrupt smooth boundary at the base of the C horizon separates Unit C from the underlying Unit B.

Unit B extends from 77 to 250 cm below the surface. The upper part of the Unit B deposit is marked by a dark 2A1b horizon of a buried paleosol with a distinct peak in the soil organic carbon content (Table 9). The Middle Woodland component was located in the upper 20 cm of Unit B and an associated radiocarbon date of 1620±70 years B.P. indicates that Unit B was deposited prior to Middle Woodland times (Peterson and Schmits 1982). The 2A1b horizon grades into a thick, silty clay loam 2Bw1b horizon characterized by a moderate to weak, medium angular blocky structure and thin, nearly continuous, silt coatings on the ped surfaces. The lower parts of Unit B consists of a 2Cb horizon lacking evidence of structural development. Calcium carbonate has been completely leached from Unit B.

The contact of Unit B with the underlying Unit A is marked by sharp color and textural changes (Tables 8 and 9). Clay content increases from 33 percent in the lower 20 cm of Unit B to 53 percent in the upper 20 cm of Unit A. The soil formed in Unit A appears to be an overthickened A1 horizon of a buried paleosol as is indicated by a peak in organic carbon content at a depth of 260-280 cm (Table 9) and a very dark grayish brown (10YR3/2) color. Sediments below the surface of the paleosol are gleyed gray sediments marked by ferrugineous precipitates resulting from fluctuating ground water conditions. This 3ACg horizon is characterized by a weak, medium subangular blocky structure. Stress cutans, or slickensides, are present on the ped faces. The entire Unit A profile is leached of carbonates.

The depositional environment reflected by the Unit A sediments is clearly one of a former floodplain. The surface of the buried 3A1 horizon is almost horizontal, and a channel fill deposit was located in Unit A along the cutbank north of the excavation. Furthermore, the deposition of fine textured, organic-enriched sediments like those of Unit A is characteristic of floodplain environments. The environment of the site was subjected to frequent flooding and it is likely that the clay-rich sediments of Unit A are overbank flood basin deposits. Thus, the development of the overthickened A/AC profile is due to deposition of sediments rich in organic matter and/or to organic matter at the site being continually buried. The gains in organic matter were not balanced by decompositional losses, and these gains, combined with deposition at the surface, producing a thick buried A horizon. The high clay content present in this profile appears to have resulted from the deposition of high clay content sediments at the site rather than to clay formation as a result of pedogenesis.

Table 8. Soil profile description for the north wall of the excavation at 23JA143.

DEPOSITIONAL UNIT	SOIL HORIZON	DEPTH (cm)	DESCRIPTION
C	A1	0-20	Very dark grayish brown (10YR3/2) silt loam, grayish brown (10YR5/2) dry; weak fine granular structure; friable; many very fine roots; slightly acid; gradual smooth boundary.
C	C	20-77	Dark brown (10YR3/3) silty clay loam, brown (10YR5/3) dry; weak fine granular structure; friable; common fine roots; neutral; abrupt smooth boundary.
B	2A1b	77-97	Very dark grayish brown (10YR3/2) silty clay loam, (10YR5/2) dry; weak fine subangular blocky structure; firm common fine pores; slightly acid; gradual smooth boundary.
B	2Bw1b	97-157	Dark brown (10YR3/3) silty clay loam, grayish brown (10YR5/2) dry; few fine brownish yellow (10YR5/6) mottles; weak medium subangular blocky structure; firm; light brownish gray (10YR6/2) silt coatings on faces of peds; common fine pores; neutral; abrupt smooth boundary.
B	2Bw2b	158-183	Dark brown (10YR3/3) silty clay loam, grayish brown (10YR5/2) dry; few fine distinct brownish yellow (10YR5/6) mottles; weak medium angular blocky structure; firm; light brownish gray (10YR6/2) silt coatings on faces of peds; common fine pores; neutral; gradual smooth boundary.
B	2Cb	183-250	Grayish brown (10YR5/2) silty clay loam, light brownish gray (10YR6/2) dry; common fine distinct yellowish brown (10YR5/6) mottles; massive; firm; common fine pores; neutral; abrupt smooth boundary.
A	3A1b	250-312	Very dark grayish brown (10YR3/2) clay, dark grayish brown (10YR4/2) dry; weak medium subangular blocky structure; firm; common slickensides on faces of peds; neutral; common fine distinct yellowish red (10YR5/6) mottles in lower 30 cm; gradual smooth boundary.

continued

Table 8 continued. Soil profile description for the north wall of the excavation at 23JA143.

DEPOSITIONAL UNIT	SOIL HORIZON	DEPTH (cm)	DESCRIPTION
A	3ACgb	312-377	Dark grayish brown (2.5YR4/2) clay, grayish brown (2.5YR15/2) dry; common fine distinct yellowish red (10YR5/6) and dark yellowish brown (10YR4/6) mottles; weak medium subangular blocky structure; firm; common slickensides on surfaces of peds; neutral; common charcoal flecks, animal bones and chert artifacts in the lower 40 cm.

Table 9. Physical and chemical properties of soils at 23JA143.

SAMPLE* NUMBER	UNIT	HORIZON	DEPTH (cm)	GRAIN SIZE DISTRIBUTION Sand (%)	Silt (%)	Clay (%)	pH	ORGANIC CARBON (%)
1	C	A1	0-20	16	62	22	6.3	3.1
2	C	C	40-60	15	54	31	7.0	1.2
3	B	2A1b	80-90	12	60	28	6.5	1.7
6	B	2Bw1b	140-150	14	52	34	6.7	1.3
8	B	2Cb	230-240	12	56	32	6.8	0.6
9	A	3A1b	260-270	9	38	53	6.7	1.1
10	A	3A1b	290-300	11	42	47	6.7	0.8
11	A	3ACgb	320-330	11	40	49	6.8	0.7
12	A	3ACgb	350-360	11	40	49	6.8	0.7

*Samples 4, 5, and 7 were not analyzed.

RADIOCARBON DATES

Two radiocarbon dates are available from the buried Middle Archaic component at 23JA143 (Table 10). Both are on wood charcoal and are based on a radiocarbon half-life of 5568 years. The first date of 6660±180 years B.P. was obtained from Feature 2 at a depth of 5.3-5.4 m below datum. The second date of 6580±120 years B.P. was obtained from a charcoal concentration northeast of Feature 8. Both dates fall within a close interval and indicate an early Middle Archaic cultural affiliation for the buried cultural deposit at 23JA143.

Table 10. Radiocarbon dates from the early Middle Archaic component at 23JA143.

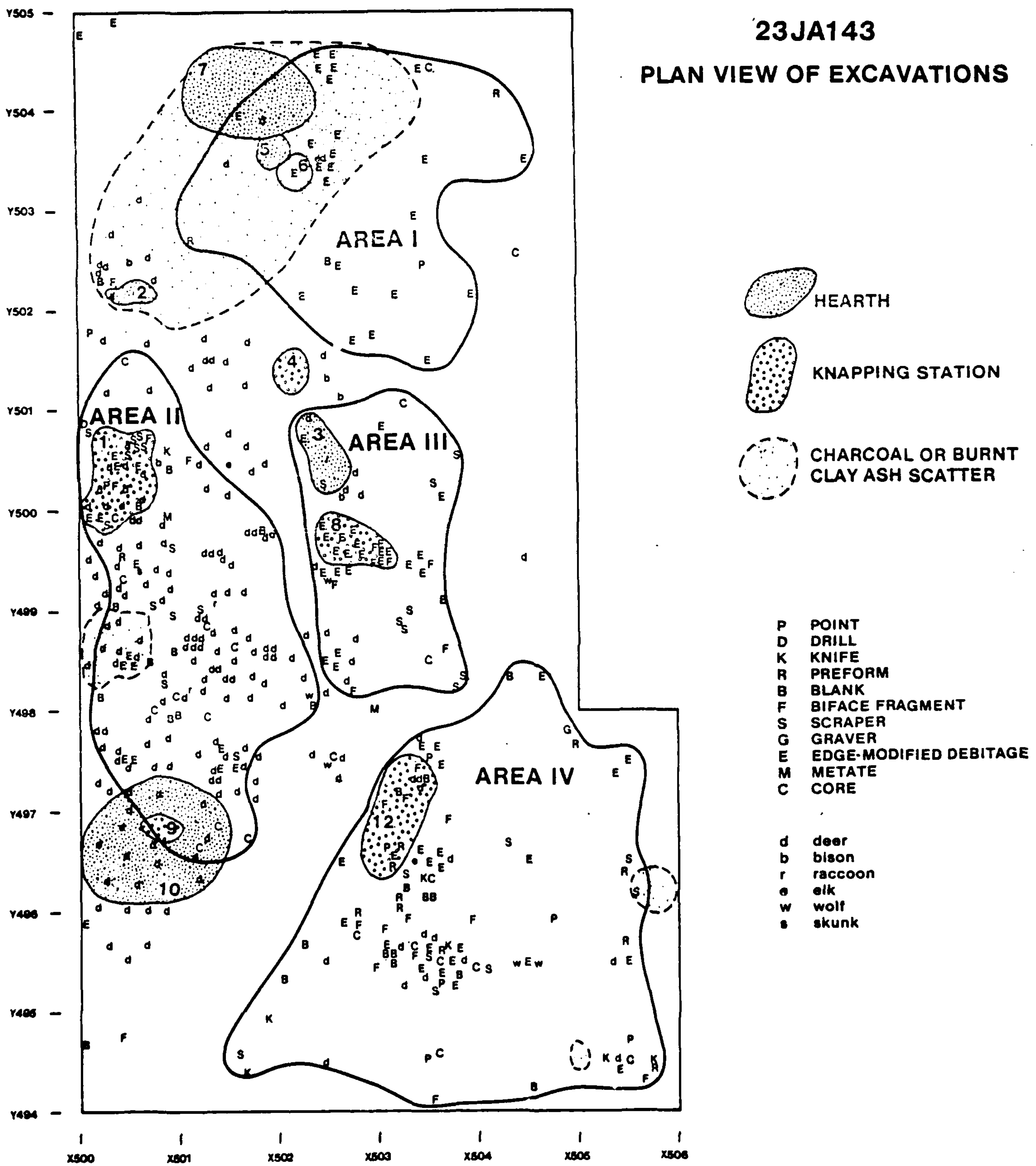
SAMPLE NUMBER	LABORATORY NUMBER	PROVENIENCE	DATUM DEPTH (m)	DEPOSITIONAL UNIT	DATE B.P.
23JA143-2	Beta-8535	Feature 2	5.3-5.4	A	6660±100
23JA143-3	Beta-12001	X503,Y500	5.2-5.4	A	6580±120

CULTURAL FEATURES

A total of 12 features were recovered from the buried Middle Archaic component at 23JA143. The 12 features were designated as Features A-L in the field. They have been renumbered as Features 1-12 in the present analysis. Included are five hearths, five debitage concentrations, interpreted to be chert knapping stations, and two refuse areas. One of the latter features (Feature 11) was assigned a feature number since it was located along the cutbank of the Little Blue River north of the block excavation. Location of the excavation and features is shown in Figure 12. Micro debris recovered from the flotation of the feature matrix samples is presented in Table 11.

Feature 1: A large irregularly shaped concentration of lithic waste debris 102 cm in length, 66 cm in width and approximately 6 cm in thickness. The artifacts recovered include one projectile point, one biface blank, two biface fragments, five flake scrapers, one edge-modified chunk, four edge-modified flakes and 802 pieces of lithic manufacturing debris. The lithic manufacturing debris included one core fragment, 285 flakes, 493 chips, 16 pieces of shatter and seven chunks. Small fragments of bone and pieces of charcoal were also scattered throughout the feature. Flotation of the 31.1 liter feature matrix recovered an additional 734 pieces of micro-debitage, 238 small unworked bone fragments, one carbonized nutshell and three carbonized seeds. Analysis of of a sample the debitage indicates that 12.2 percent are decortication flakes, 65.0 percent are intermediate flakes and 22.8 percent are bifacial trimming flakes. Nearly 25 percent of the sample was tan Winterset chert. The remainder was gray Winterset chert.

Feature 2: A small oval hearth consisting of a concentration of burnt clay and charcoal 48 cm in length, 20 cm in width and 3 cm in depth. A large diffuse scatter of burnt clay and charcoal surrounded the hearth and extended to the north and east toward Features 5, 6 and 7. Artifacts from Feature 2 included one flake, five chips and two unworked bones. Charcoal from Feature 2 has been dated at 6600±100 years B.P. Flotation of the feature fill recovered 126 pieces of micro-debitage, 65 unworked bone fragments, two carbonized seeds and a small number of



Figu.'e 12. Plan view of the features and activity areas at 23JA143.

Table 11. Micro-debris recovered from the flotation of feature matrix samples at 23JA143.

FEATURE NUMBER	FEATURE TYPE	VOLUME (liters)	DEBITAGE	UNWORKED BONE	CARBONIZED NUTSHELLS	CARBONIZED SEEDS	CHARCOAL*
1	Flaking Area	31.1	734	238	1	3	
2	Hearth	35.6	126	65		2	L
3	Hearth	25.0	107	233	11	2	L
5	Hearth	8.0	61	46			L
6	Refuse Area	2.0	55	41	3		L
7	Hearth	69.0	90	79	3	1	L
9	Flaking Area	5.0	131				
10	Hearth	35.0	191	747	40	1	L
12	Flaking Area	15.0	669	359			
TOTAL		225.7	2164	1808	58	9	

*L=Light, M=Moderate

charcoal fragments.

<u>Feature 3</u>: An oval concentration of burnt clay, charcoal and burnt bone approximately 83 cm in length, 45 cm in width and 11 cm in depth. A small amount of lithic debris was recovered from the feature including one scraper, two flakes and three chips. Faunal remains recovered from the feature include a fragment of a bison (<u>Bison bison</u>) skull, several deer (<u>Odocoileus virginianus</u>) elements and a fragment of a raccoon (<u>Procyon lotor</u>) maxillae. A large fragment of a deer cranium was located just southeast of the feature. Flotation of the 25 liter feature matrix recovered 107 pieces of micro-debitage, 253 small fragments of unworked bone, 11 carbonized nutshells and two carbonized seeds.

<u>Feature 4</u>: A small circular concentration of debitage 42 cm in diameter and 5 cm in thickness. A total of 77 flakes, 495 chips and two pieces of shatter were recovered. A sample of the debitage was analyzed and consisted of 68.5 percent bifacial trimming flakes and 31.5 percent intermediate flakes. The absence of decortication flakes and the high frequency of bifacial trimming flakes indicate that the final stages of lithic reduction occurred at this feature.

<u>Feature 5</u>: A small, circular area of charcoal and burnt clay 34 cm in diameter and 13 cm deep located adjacent to Feature 7. Eleven chips were recovered from the excavation. Flotation of the 8 liter matrix sample recovered 61 pieces of micro-debitage and 46 small bone fragments.

<u>Feature 6</u>: A small circular area of concentrated debris, charcoal and burnt clay 34 cm in diameter and 3 cm in depth. Artifacts recovered

included one edge-modified flake, three flakes, five chips, two pieces of shatter and 12 fragments of unworked bone. Flotation of the 5 liter fill recovered 55 pieces of micro-debitage, 41 pieces of bone and three carbonized nutshells. Feature 6 appears to be a small refuse area associated with the hearths in this area of the site.

Feature 7: A large oval shaped concentration of charcoal and burnt clay 122 cm in length, 98 cm in width and 13 cm in thickness. Artifacts recovered from the feature include one edge-modified chunk, four flakes, seven chips, one piece of shatter, 13 small unworked stones and a small sample of charcoal. Flotation of the 69 liters of matrix recovered an additional 90 pieces of micro-debitage, 79 small pieces of unworked bone, three carbonized nutshells and one carbonized seed. A few small flakes were heated and a small number of the unworked bone fragments were burnt.

Feature 8: A large oval concentration of lithic manufacturing debris extending over an area 93 cm in length, 52 cm in width and 4 cm in thickness. Artifacts recovered from the feature included three biface fragments, 12 edge-modified flakes, 335 flakes, 455 chips, 18 chunks, 14 pieces of shatter and two unworked stones. Flotation of the matrix recovered an additional four edge-modified flakes, 180 flakes, 2658 chips, three chunks, 56 pieces of shatter and nine small bone fragments. A sample of debitage analyzed consisted of 3.2 percent decortication flakes, 56.8 percent intermediate flakes and 39.6 percent bifacial trimming flakes. A single resharpening flake was also present in the sample.

Feature 9: A small oval concentration of lithic manufacturing debris located in and slightly above the Feature 10 hearth. The debitage scatter was 40 cm in length, 27 cm in width and 3 cm in thickness. The artifacts recovered included 41 flakes, 468 chips and two pieces of shatter. An additional 131 pieces of micro-debitage were recovered from a 5 liter sample of the feature fill. None of the debitage appears to have been heated or burnt by the fire in the hearth. Analysis of a sample of the debitage from the feature indicates that the debitage consists of 76.8 percent bifacial trimming flakes and 23.2 percent intermediate flakes. No decortication flakes were present.

Feature 10: A large oval concentration of burnt clay and charcoal located in the southwestern corner of the excavation and identified as a hearth. The feature was 160 cm in length, 125 cm in width and had a depth of 6 cm. Artifacts recovered include five flakes, four chips, one piece of shatter, 80 pieces of unworked bone and a small sample of charcoal. Flotation of the 35 liter feature matrix produced an additional 191 pieces of micro-debitage, 747 small bones, 40 carbonized nutshells and one carbonized seed. The identifiable bone includes the partial remains of at least two white-tailed deer (*Odocoileus virginianus*) scattered in and around the feature. Most of the larger and more complete bones are unburnt, while many of the smaller fragments are burnt. Only a few pieces of the debitage have been heated.

Feature 11: A concentrated area of lithic and faunal materials located along the cutbank of the Little Blue River north of the block

excavation. Feature 11 was located at the same depth and stratigraphic position in Unit A as the cultural deposit in the block excavation. Artifacts recovered include one projectile point, one biface blank, two biface fragments, two cores, three modified flakes, 44 flakes, 103 chips, four pieces of shatter, one abrader and a large rib bone.

Feature 12: A large debitage scatter consisting of two circular concentrations of debitage separated by a light lithic scatter. The concentration located to the south was approximately 45 cm in diameter and contained one projectile point, two broken preforms which cross-mended, an edge-modified flake, one chunk, 43 flakes and 61 chips. The concentration to the north was slightly larger (59 by 53 cm) and contained two broken blanks, two biface fragments, 75 flakes, 226 chips, 14 pieces of shatter and one chunk. The feature was approximately three cm in thickness. A sample of the debitage from the feature was analyzed and contained 5.3 percent decortication flakes, 38.7 percent intermediate flakes, 53.9 percent bifacial trimming flakes and 2.1 percent resharpening flakes. Both areas within the feature produced similar percentages of flake types. A total of 669 pieces of micro-debitage and 359 small pieces of bone were recovered from the 15 liter matrix sample.

LITHIC ASSEMBLAGE

The lithic assemblage recovered from the Middle Archaic component at 23JA143 includes 216 chipped stone tools, three ground stone implements, 7117 pieces of lithic manufacturing debris, nine minerals and 124 unworked stones (Table 12). The distribution of this material by excavation level is presented in Table 12. As can be seen, nearly all of the material is from a 30 cm interval from 5.1-5.4 meters below datum.

Chipped Stone Tools

The 216 chipped stone tools include ten projectile points, seven bifacial knives, 13 bifacial preforms, one drill, 27 bifacial blanks, 26 biface fragments, eight unifacial scrapers, 22 marginally retouched flake scrapers, one marginally retouched graver and 101 pieces of edge-modified debitage. The chipped stone tool assemblage is almost entirely local gray Winterset chert although a small percentage is tan Winterset chert. A single Westerville chert tool is also present.

Projectile Points (n=10)

A total of ten projectile points were recovered from the Middle Archaic component (Table 13). Although only one is complete, an additional five are sufficiently large so that the overall morphology can be inferred (Figure 13a-f). The remaining four are small proximal fragments (Figure 13g-i).

Table 12. Artifact assemblage from 23JA143.

	METERS BELOW DATUM								
	4.8-4.9	4.9-5.0	5.0-5.1	5.1-5.2	5.2-5.3	5.3-5.4	5.4-5.5	RIVERBANK	TOTAL
CHIPPED STONE TOOLS									
Projectile Points				2	7	1			10
Bifacial Knives				3	4				7
Bifacial Preforms					12	1			13
Bifacial Drill						1			1
Bifacial Blanks	1		1	4	13	8			27
Bifacial Fragments				3	18	5			26
Unifacial Scrapers				3	4	1			8
Flake Scrapers				2	9	11			22
Graver						1			1
Edge-Modified Cores					1	1			2
Edge-Modified Flakes	1	2	2	17	51	21		3	97
Edge-Modified Chunks			1		1				2
Total	2	2	4	34	120	51		3	216
GROUND STONE TOOLS									
Metates					1	1			2
Abrader								1	1
Total					1	1		1	3

continued

Table 12 continued. Artifact assemblage from 23JA143.

				METERS BELOW DATUM					
	4.8-4.9	4.9-5.0	5.0-5.1	5.1-5.2	5.2-5.3	5.3-5.4	5.4-5.5	RIVERBANK	TOTAL
LITHIC MANUFACTURING DEBRIS									
Cores				6	12	7			25
Chunks				10	54	14	1		79
Flakes	2	10	22	224	1269	575	1	75	2178
Chips	4	33	77	430	3117	803	6	122	4592
Shatter		7	6	28	156	41		5	243
Total	6	50	105	698	4608	1440	8	202	7117
MINERALS					9				9
UNWORKED STONE				67	17	40			124
TOTAL	8	52	109	799	4755	1532	8	206	7469

Table 13. Descriptive data for projectile points from 23JA143.

CATALOG NUMBER	PROVENIENCE	DATUM DEPTH (m)	USE-WEAR*	CHERT TYPE**	DIMENSIONS (mm) LGTH	WDTH	THICKNESS	STEM WDTH	BASE WDTH	STEM LGTH	NOTCH WDTH	NOTCH DEPTH	WEIGHT (g)
307	Feature 1	5.33	GC,IF	WN	47	21	6	13	18	10	9	4	6.8
344	X500, Y501	5.35	GC	TWN	-	18	6	12	-	9	7	3	1.8
989	X503, Y495	5.21	GC	WN	-	22	7	14	19	10	5	4	7.4
1024	Feature 12	5.24	GC	WN	43	21	8	14	21	8	5	4	5.6
1055	X503, Y497	5.15	NE	WN	-	-	5	13	18	8	4	-	0.8
1203	X504, Y495	5.25	NE	WN	-	-	5	15	19	9	4	-	1.0
1262	X503, Y502	5.26	NE	WN	-	-	5	14	19	10	6	-	1.2
1294	X505, Y494	5.22	GC	WN	-	20	6	15	20	9	6	3	3.5
1359	Feature 11	5.30	HDC	WN	-	20	7	12	18	10	7	4	4.0
1381	X503, Y494	5.20	NE	WN	-	-	-	14	18	-	-	-	0.6

*GC=General Cutting, HDC=Heavy-Duty Cutting, IF=Impact Fracture, NE=No Edges Present,
**WN=Winterset, TWN=Tan Winterset

Figure 13. Projectile points from 23JA143.

All ten points are small side-notched points made from subtriangular preforms. Four have straight bases and six have concave bases. The side notches range from 4-9 mm in width and 3-4 mm in depth. All ten specimens have ground bases and ground notches to facilitate hafting. Nine are made from unheated gray Winterset chert and one is unheated tan Winterset chert. All six points with intact blade sections exhibit use-wear. Five have general cutting wear and the sixth exhibits heavy-duty cutting wear. Additionally, one point is impact fractured. The evidence of use-wear indicate that these points served both as hafted cutting tools and as tips for projectiles.

Bifacial Drill (n=1)

The drill is a distal or bit section made from unheated Winterset chert (Figure 14a). One edge of the bit exhibits pronounced abrasive wear indicative of heavy-duty boring. The absence of wear on the other edge suggests the tool was in the process of being resharpened when it fractured.

Bifacial Knives (n=7)

A total of seven bifacial knives were recovered, however four fragmentary specimens cross-mend reducing the total number of knives to five (Table 14). The five knives include three complete (cross-mended) specimens and two with transverse fractures (Figure 14b-c). These knives are small to medium sized subtriangular bifaces with thin lenticular cross-sections. Four have been secondarily thinned and the fifth has only primary bifacial thinning (Figure 14b). Five are gray Winterset chert and one is tan Winterset chert. All five bifacial knives exhibit use-wear including four with heavy-duty cutting wear and one with general cutting wear.

Bifacial Preforms (n=13)

The thirteen bifacial preforms include two bifaces which cross-mend reducing the total number of preforms to eleven. The preforms are generally subtriangular in plan form with lenticular cross-sections. All are secondarily thinned and most have steep marginal pressure retouch along the lateral edges that appears to be platform preparation. Larger thinning flakes have been driven off of the opposing face of the platforms. All are unheated Winterset chert and exhibit no evidence of use-wear.

Seven small preforms have mean dimensions very close to those of the projectile points and appear to have been discarded prior to final thinning and shaping into points (Figure 15a-g). The remaining four preforms include the two cross-mended artifacts and are slightly larger and appear to have been discarded when they broke during manufacture (Figure 15h-k). All four have transverse fractures.

Bifacial Blanks (n=27)

Twenty-seven bifacial blanks were recovered. Eight of these cross-mend reducing the total number of blanks to 23. The blanks range from thick bifaces with irregular or plano-convex cross-sections to thin subtriangular or subrectangular bifaces with thick ridges or bumps (Figure 14f-l).

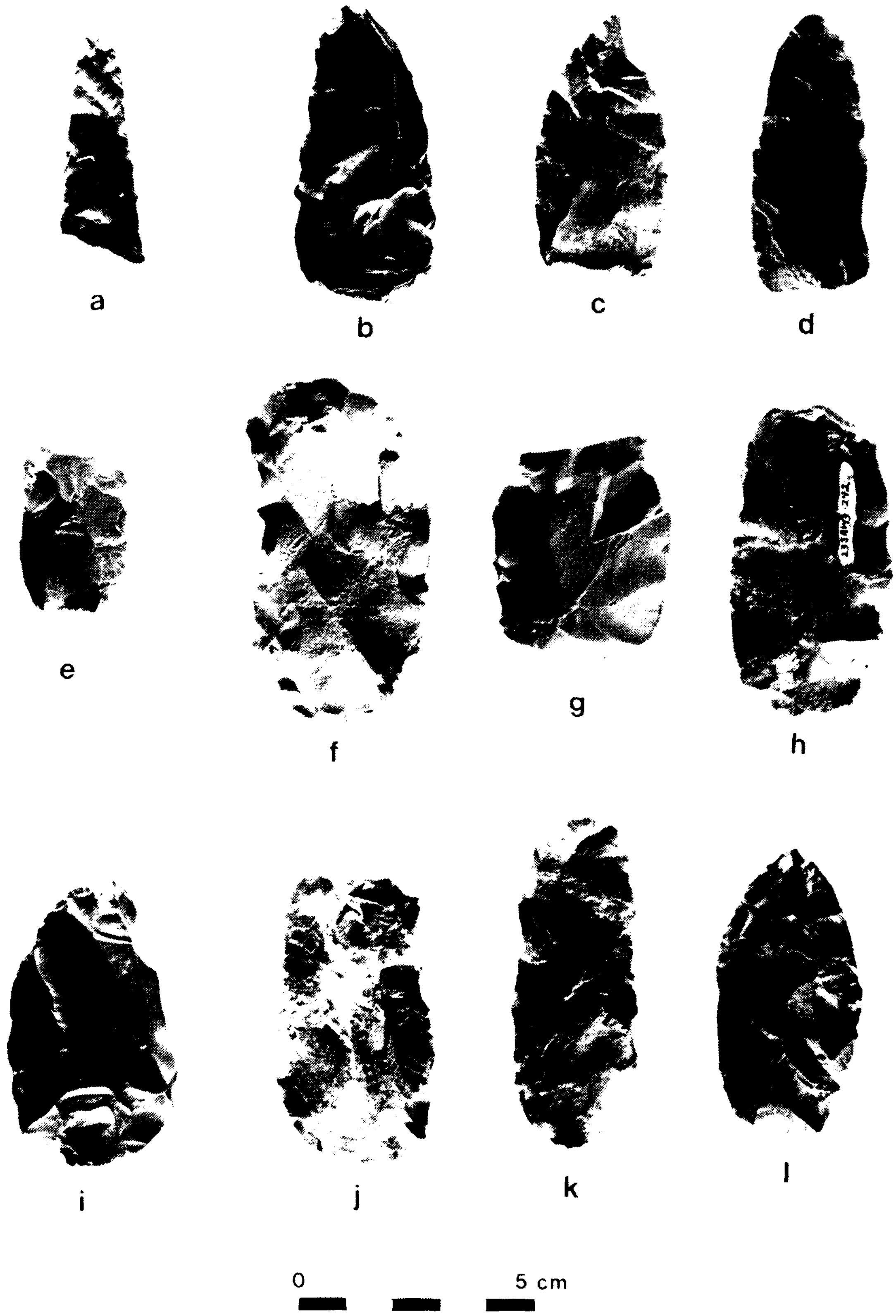


Figure 14. Bifacial tools from 23JA143: a, drill; b-e, knives; f-l, blanks.

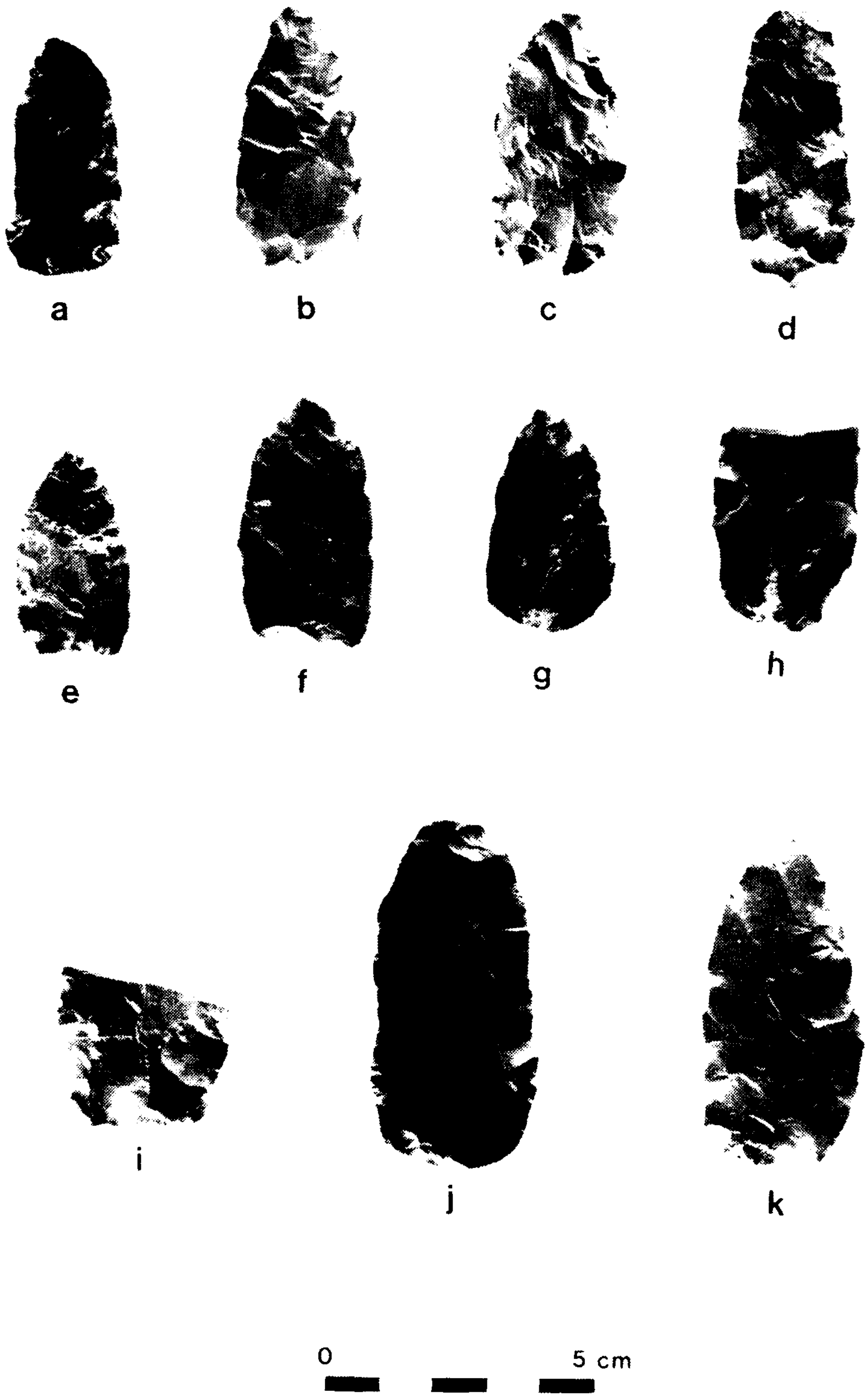


Figure 15. Bifacial preforms from 23JA143.

Table 14. Descriptive data for bifacial tools from 23JA143.

CATALOG NUMBER*	PROVENIENCE	DATUM DEPTH	USE-WEAR **	CHERT TYPE ***	TOOL TYPE	WEIGHT (g)	DIMENSIONS (mm) LGTH	WDTH	THICK -NESS
298	X500,Y500	5.18	HDC	WN	Knife	21.0	67	32	12
*645,	X501,Y494	5.27	GC	TWN	Knife	9.4	-	28	8
*646	X501,Y494	5.28		TWN	Knife				
*973,	X503,Y495	5.15	HDC	WN	Knife	10.9	60	26	6
*1297	X505,Y494	5.26		WN	Knife				
1033	X503,Y496	5.23	HDC	WN	Knife	7.2	-	25	7
1295	X505,Y494	5.21	HDC	WN	Knife	15.3	58	31	8
322	X500,Y500	5.36	HDC	WN	Drill	6.9	-	19	10
277	X500,Y499	5.38		WN	Preform	8.6	44	25	9
487	X501,Y502	5.21		WN	Preform	7.8	38	23	9
746	X502,Y496	5.28		WN	Preform	9.3	46	27	8
*991,	X503,Y495	5.21		WN	Preform	16.0	63	31	8
*1325	X505,Y496	5.22		WN	Preform				
*1025,	Feature 12	5.25		WN	Preform	20.5	68	34	8
*1026	Feature 12	5.26		WN	Preform				
1031	X503,Y496	5.26		WN	Preform	8.0	46	22	7
1032	X503,Y496	5.28		WN	Preform	12.7	51	27	11
1222	X504,Y497	5.25		WN	Preform	9.8	-	28	8
1277	X504,Y504	5.29		WN	Preform	11.0	54	24	10
1296	X505,Y494	5.25		WN	Preform	7.9	50	26	7
1312	X505,Y495	5.24		WN	Preform	9.1	-	33	9
189	X500,Y497	5.30		WN	Blank	21.7	-	37	14
198	X500,Y497	5.31		WN	Blank	36.1	-	36	16
241	X500,Y498	5.33		WN	Blank	24.2	47	36	16
242	X500,Y498	5.34		WN	Blank	44.9	69	36	19
243	X500,Y498	5.35		WN	Blank	50.3	52	42	21
*278,	X500,Y499	5.37	GC	WN	Blank	40.5	81	36	16
*789	X502,Y498	5.29		WN	Blank				
*308,	Feature 1	5.32		WN	Blank	20.8	71	28	11
*311	X500,Y500	5.30		WN	Blank				
350	X500,Y502	5.19		WN	Blank	10.0	37	28	10
442	X501,Y499	5.32		WN	Blank	32.8	63	37	15
719	X502,Y495	4.85		WN	Blank	18.6	50	35	11
735	X502,Y495	5.34	HDS	WN	Blank	8.4	-	-	10
896	X502,Y502	5.30		WN	Blank	23.6	-	-	14
*969,	X503,Y495	5.10	GC	WN	Blank	9.6	-	35	10
*976	X503,Y495	5.15		WN	Blank				
975	X503,Y495	5.14		WN	Blank	10.4	-	-	10
994	X503,Y495	5.24	GS	WN	Blank	57.6	72	55	17
1034	X503,Y496	5.27		WN	Blank	20.9	-	40	11
1035	X503,Y496	5.29		WW	Blank	7.8	-	-	10
1036	X503,Y496	5.29		WN	Blank	52.1	-	-	26
1063	X503,Y497	5.24		WN	Blank	13.1	-	-	11
1064	X503,Y497	5.24		WN	Blank	17.7	-	-	11
*1182,	X504,Y494	5.16	GS	WN	Blank	17.0	62	34	10

continued

Table 14 continued. Descriptive data for bifacial tools from 23JA143.

CATALOG NUMBER*	PROVENIENCE	DATUM DEPTH	USE-WEAR **	CHERT TYPE ***	TOOL TYPE	WEIGHT (g)	DIMENSIONS (mm) LGTH	WDTH	THICK-NESS
*1237	X504,Y498	5.25		WN	Blank				
1358	X500,Y494	5.37		WN	Blank	45.3	77	41	15
1360	X496,Y514	5.26	GC	WN	Blank	10.2	-	-	9
309	Feature 1	5.31	GC	WN	Fragment	5.1	-	-	9
310	Feature 1	5.32		WN	Fragment	[illegible]	-	-	10
351	X500,Y502	5.20	GS	WN	Fragment	8.3	-	-	8
458	X501,Y500	5.27		WN	Fragment	2.4	-	-	7
587	X500,Y494	5.37		WN	Fragment	15.8	-	-	16
726	X502,Y495	5.28		WN	Fragment	15.2	-	-	9
727	X502,Y495	5.25		WN	Fragment	5.8	-	-	7
790	X502,Y498	5.28		WN	Fragment	13.1	-	-	13
827	X502,Y499	5.23	HDS	WN	Fragment	22.4	-	-	19
828	X502,Y499	5.23		WN	Fragment	22.3	-	-	16
842	X502,Y499	5.32	GS	WN	Fragment	9.4	-	-	13
967	X503,Y494	5.32		TWN+	Fragment	10.1	-	-	12
974	X503,Y495	5.12		WN	Fragment	6.8	-	-	7
990	X503,Y495	5.23	GC	WN	Fragment	23.2	-	-	10
992	X503,Y495	5.27		WN	Fragment	1.8	-	-	5
993	X503,Y495	5.23		WN	Fragment	20.1	-	-	12
1021	X503,Y496	5.19		WN	Fragment	1.3	-	-	7
1065	Feature 12	5.25	GC	WN	Fragment	7.3	-	-	8
1067	Feature 12	5.25		WN	Fragment	12.3	-	-	12
1077	X503,Y497	5.32		WN	Fragment	5.4	-	-	8
1087	X503,Y498	5.23		WN	Fragment	14.6	-	-	15
1104	X503,Y499	5.25		WN	Fragment	4.2	-	-	9
1113	Feature 8	5.22	GS	WN	Fragment	0.9	-	-	5
1298	X505,Y494	5.28	GC	WN	Fragment	5.0	-	-	9
1361	Feature 11	5.27		WN	Fragment	16.5	-	-	16
1362	Feature 11	5.27		WN	Fragment	17.2	-	-	18

*Cross-Mended Fragments
**=HDC=Heavy-Duty Cutting, GC=General Cutting, GS=General Scraping, HDS=Heavy-Duty Scraping
***WN=Winterset, TWN=Tan Winterset, +=Heated

Seven blanks are complete while 16 fragments and cross-mended specimens appear to have broken during the reduction process. All twenty-three blanks are unheated Winterset chert. Five blanks exhibit use-wear including three with general cutting wear, one with general scraping wear and one with heavy-duty scraping wear.

<u>Biface Fragments</u> (n=26)

A total of 26 biface fragments were recovered. Most of these are thick biface which appear to be blanks which broke during manufacture. Six are small and are sufficiently thinned to have been preforms, knives

or projectile points. Twenty-five of the 26 fragments are unheated Winterset chert and one is heated tan Winterset. Eight specimens exhibit use-wear, including three with general scraping wear, one with heavy-duty scraping wear and four with general cutting wear.

Unifacial Scrapers (n=8)

A total of eight unifacial scrapers were recovered (Table 15). Three complete specimens are thick blocky scrapers (Figure 16a), two additional complete scrapers appear suitable for hafting (Figure 16b-c) and three are fragments. All of the unifacial scrapers are unheated Winterset chert. Seven have general scraping wear and three have pronounced light-duty scraping wear.

Flake Scrapers (n=22)

A total of 22 marginally retouched scrapers were recovered. Nineteen are end scrapers (Figure 16d-g) and two are side scrapers (Figure 16h). The end scrapers include nine made on oval flakes, seven on elongated flakes or blades, two on triangular flakes and two on thick irregular pieces of chert. The two side scrapers are made on long rectangular flakes. All are unheated gray Winterset flakes.

Nineteen flake scrapers exhibit use-wear including twelve with general scraping wear, five with light-duty scraping wear and two with heavy-duty scraping wear. Four scrapers also exhibit cutting wear indicating they were multiple-use tools. Two of these have heavy-duty cutting wear and two have general cutting wear.

Graver (n=1)

A chunk has been marginally retouched along two edges forming a trihedral bit that has graving/incising wear (Figure 16i). The tool is made of unheated Westerville chert.

Edge-Modified Debitage (n=101)

A total of 101 pieces of edge-modified debitage were recovered. Included are 97 flakes, two chunks and two cores. The edge-modified flakes are predominantly Winterset chert with only four tan Winterset flakes present. The flakes are generally medium to large-sized and exhibit one or more utilized or retouched edges. The chunks and cores are small to medium-sized pieces of unheated Winterset chert.

The 101 edge-modified tools exhibit 135 individual edge modifications including 24 retouched edges and 115 utilized edges (Table 16). The utilized edges include 26 (22.6 percent) with light-duty cutting wear, 16 (13.9 percent) with heavy-duty cutting wear, 34 (29.6 percent with light-duty scraping wear, 29 (25.2 percent) with heavy-duty scraping wear, six (5.2 percent) with boring/piercing wear and four (3.5 percent) with graving/incising wear. A majority of the edges (57.4 percent) were utilized to scrape, cut or pierce soft materials and 42.6 percent were used on hard materials.

Lithic Manufacturing Debris

The lithic manufacturing debris from 23JA143 includes 25 cores, 79

Table 15. Descriptive data for unifacial and marginally retouched tools from 23JA143.

CATALOG NUMBER	PROVENIENCE	DATUM DEPTH (m)	USE-WEAR **	CHERT TYPE ***	TOOL TYPE	WEIGHT (g)	DIMENSIONS (mm) LGTH	WDTH	THICK -NESS
221	X500,Y498	5.18	LDS	WN	Scraper*	29.5	69	39	13
244	X500,Y498	5.34	LDS	WN	Scraper	16.8	66	34	9
279	X500,Y499	5.38	HDS	WN	Scraper	30.0	66	40	18
280	X500,Y499	5.39	LDS	WN	Scraper*	97.1	74	52	30
283c	Feature 1	5.25	LDS	WN	Scraper	28.4	69	29	15
312	X500,Y500	5.25	LDS	WN	Scraper*	24.9	60	30	15
323	X500,Y500	5.33		WN	Scraper*	8.0	39		12
324a	Feature 1	5.39	GS	WN	Scraper	16.6	55	43	8
324b	Feature 1	5.39	GS	WN	Scraper	9.1	49	24	9
324c	Feature 1	5.39	GS,GC	WN	Scraper	9.0	49	38	5
324f	Feature 1	5.39	GS	WN	Scraper	6.5	40	31	5
372	X501,Y497	5.24	GS	WN	Scraper	1.4	22	17	4
441	X501,Y499	5.31	GS	WN	Scraper	4.9	34	25	7
648	X501,Y494	5.36	GS	WN	Scraper	14.3	48	34	17
867	Feature 12	5.33	LDS	WN	Scraper	33.8	64	44	16
979	X503,Y495	5.15	HDS, HDC	WN	Scraper	10.6	59	28	8
995	X503,Y495	5.22		WN	Scraper	20.1	59	41	9
1037	X503,Y496	5.28	GS	WN	Scraper*	41.0	56	38	20
1085	X503,Y498	5.18	GS	WN	Scraper*	32.1	60	33	22
1088	X503,Y498	5.21	GS	WN	Scraper	7.4	43	27	6
1089	X503,Y498	5.21	LDS	WN	Scraper	9.8	50	32	6
1090	X503,Y498	5.24	GS	WN	Scraper	17.6	56	34	11
1103	X503,Y499	5.24		WN	Scraper	26.9	55	45	12
1128	X503,Y500	5.11		WN	Scraper	9.8	56	29	6
1129	X503,Y500	5.26	GS	WN	Scraper*	6.4	31	26	9
1204	X504,Y495	5.22	GS,GC	WN	Scraper	50.9	76	48	15
1214	X504,Y496	5.23	LDS	WN	Scraper	7.0	41	30	7
1229	X504,Y497	5.39	GI	WS	Graver	18.8	52	27	17
1321	X505,Y496	5.19	GS	WN	Scraper*	24.9	49	35	15
1331	X505,Y496	5.35	GS,HDC	WN	Scraper	13.2	53	31	8
1365	Feature 11	5.[illegible]5	GS	WN	Scraper	21.7	48	42	14

*Unifacial Tool
**LDS=Light-Duty Scraping, GS=General Scraping, HDC=Heavy-Duty Cutting, GI=Graving/Incising, GC =General Cutting
***WN=Winterset, WS=Westerville

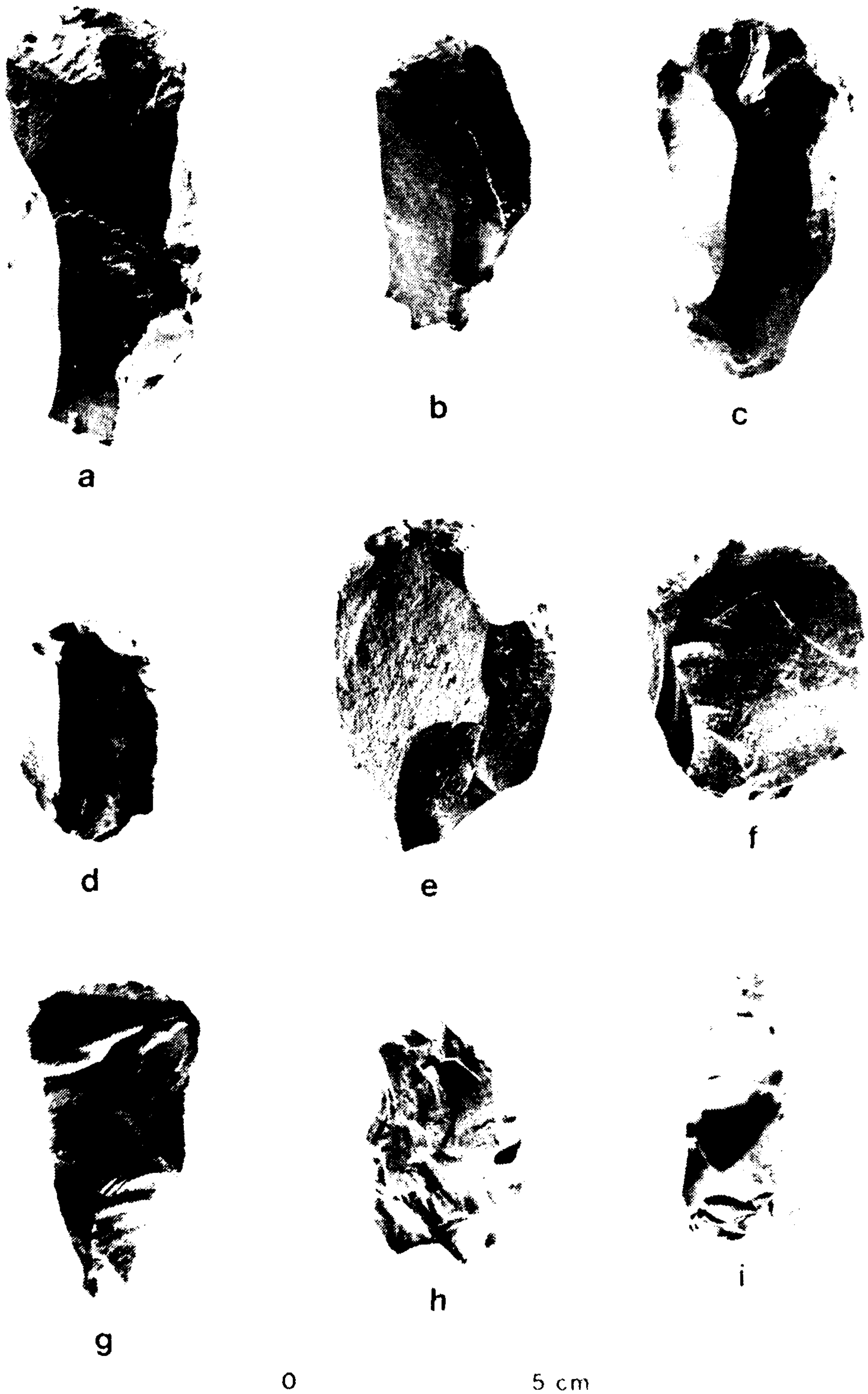


Figure 16. Unifacial and flake scrapers from 23JA143: a-c, unifacial scrapers; d-h, flake scrapers; i, graver.

Table 16. Summary of use-wear modifications on edge-modified debitage from 23JA143.

USE-WEAR	FLAKES	CHUNKS	CORES	TOTAL	PERCENT
Light-duty cutting	26			26	22.6
Heavy-duty cutting	15	1		16	13.9
Light-duty scraping	33		1	34	29.6
Heavy-duty scraping	28		1	29	25.2
Boring/Piercing	6			6	5.2
Graving/Incising	3	1		4	3.5
TOTAL	111	2	2	115	100.0

chunks, 2178 flakes, 4592 chips and 243 pieces of shatter (Table 12). This material is almost entirely of Winterset chert. Only a small number appear to have been heated and these may have been accidentally burnt in the hearths at the site.

Cores (n=25)

The 25 cores recovered include two cross-mended fragments which reduces the total to 24 (Table 17). Twenty-three of these appear to have been quarried or naturally fractured tabular pieces obtained from bedrock outcrops and one core is a stream-rolled cobble derived from secondary alluvial contexts. The cores include one fairly large prepared pyramidal core, three large tabular cores, five small tabular cores, two medium-sized block cores, two core nuclei and ten core fragments. Several cores contain internal imperfections or fractures and were likely discarded when these were encountered during reduction. The fragments, nuclei, and small tabular cores were also probably discarded as they were too small for further reduction. A total of 23 cores are gray Winterset chert and one is tan Winterset.

Chunks(n=79)

A total of 79 chunks were recovered. Many of these exhibit cortical surfaces. All are gray Winterset chert and no evidence of heating is present.

Shatter (n=243)

A total of 243 pieces of shatter were recovered. All are gray Winterset chert except for two pieces of tan Winterset chert. Ten pieces of shatter have been heated.

Flakes (n=2178)

A total of 2178 flakes were recovered. A sample of 218 flakes (10 percent) which were examined contained 19 cortical flakes (8.5 percent), 133 intermediate flakes (61.0 percent) and 66 bifacial trimming flakes (30.5 percent). The sample consisted entirely of Winterset chert, although six specimens (2.7 percent) were tan Winterset chert. Only one flake was heated.

Chips (n=4592)

A total of 4592 chips were recovered. Nearly all appear to be unheated gray Winterset chert.

Table 17. Descriptive data for cores from 23JA143.

CATALOG NUMBER	PROVENIENCE	DATUM DEPTH	CHERT TYPE***	CORE TYPE ****	WEIGHT (g)	DIMENSIONS (mm) LGTH	WDTH	THICK -NESS
222	X5[illegible]498	5.17	WN	Fragment	21.6	45	29	21
233**,	X500,Y498	5.25	WN	Tabular	270.0	109	64	41
398**	X5[illegible],Y498	5.27	WN	Tabular				
281	X5[illegible],Y499	5.37	WN	Fragment	48.7	57	51	20
284	Feature 1	5.35	WN	Fragment	27.2	47	32	19
345	X500,Y501	5.34	WN	Nuclei	24.8	41	36	23
371	X501,Y497	5.30	WN	Tabular	150.7	79	66	33
409	X501,Y498	5.32	WN	Block	112.5	74	44	39
669	X501,Y496	5.34	WN	Prepared	258.1	82	66	48
670	X501,Y496	5.35	WN	Fragment	34.2	67	24	22
671*	X501,Y496	5.35	WN	PRM	388.2	110	80	43
729	X502,Y495	5.22	WN	Block	94.6	68	49	28
761	X502,Y497	5.26	TWN	Fragment	10.0	51	18	16
957	X503,Y494	5.15	WN	Fragment	35.9	59	34	22
980	X503,Y495	5.18	WN	Tabular	249.1	97	81	48
981	X503,Y495	5.15	WN	Fragment	44.3	78	33	22
1001	X503,Y495	5.21	WN	Nuclei	55.3	68	45	24
1040	X503,Y496	5.23	WN	Fragment	56.7	64	47	30
1086	X503,Y498	5.13	WN	Fragment	48.8	87	47	19
1149	X503,Y501	5.36	WN	Tabular	66.2	66	44	24
1174	X503,Y504	5.24	WN	Tabular	50.4	64	39	20
1267	X504,Y502	5.35	WN	Fragment	55.8	70	34	26
1290	X505,Y494	5.16	WN	Fragment	11.0	48	27	11
1363	Feature 11	5.25-33	WN	Tabular	34.7	56	64	39
1364	Feature 11	5.25-5.33	WN	Tabular	34.7	56	48	13

*Hammerwear present
**Cross-mended artifacts
***WN=Winterset; TWN=Tan Winterset
****PRM=Procured Raw Material

Unworked Stone

A total of 124 pieces of unworked stone with a combined weight of 971 g were recovered. The majority of these (n=117) are small pebble-sized pieces of sandstone. Six small fragments of limestone and a small piece of gray volcanic pumice are also present. Twenty larger pieces of sandstone (482 g) and five pieces of limestone (94 g) have

been thermally oxidized indicating their use as hearthstones.

Ground Stone Tools

Ground stone tools from 23JA143 include two metates and one abrader.

Metates (n=2)

One metate is of a thin subrectangular grinding slab 30 mm in length, 27 mm in width and 22 mm in thickness (Figure 17a). The metate was made from a tabular piece of soft light-gray sandstone probably derived from the local Graydon formation. This sandstone is soft and the metate had fractured into a number of small pieces. The metate has a shallow ground surface on one side. The second metate was also fragmented and consisted of a number of thin tabular pieces of sandstone which exhibited a smoothed flat or slightly concave surface. All of the fragments are a light brownish gray sandstone and range from 9 to 19 mm in thickness. These fragments are clearly pieces of the same grinding slab and a number of the fragments cross-mended allowing partial reconstruction of the metate (Figure 17b). This metate also appears to be Graydon formation sandstone.

Both metates appear to have been used for light-duty milling tasks based on the morphology and wear on the surfaces. Both are long and wide relative to their thickness of 19 to 22 mm. Since the metates are made from a thin soft sandstone, they do not appear suitable for abrasion of hard materials. Both implements have a ground surface and lack deep striations, pits or grooves which would result from use on hard objects. The metates most likely were used in the processing of softer vegetal materials such as nuts or seeds.

Abrader (n=1)

The abrader is made from a light reddish-brown piece of pumice and has a length of 45 mm and width of 38 mm. It exhibits two relatively broad shallow grooves approximately 12 mm wide and 4 mm in depth. One groove has a semi-circular cross-section and was probably used to smooth wood shafts (Figure 17c).

Minerals

Seven small pieces of hematite, one sample of hematite-stained soil and one sample of limonite-stained soil were recovered. The largest piece of hematite is 52 mm in length, 24 mm in width and 9 mm in thickness and has been partially ground. It has a plano-convex cross-section. Parallel striations were observed along the length of the convex side.

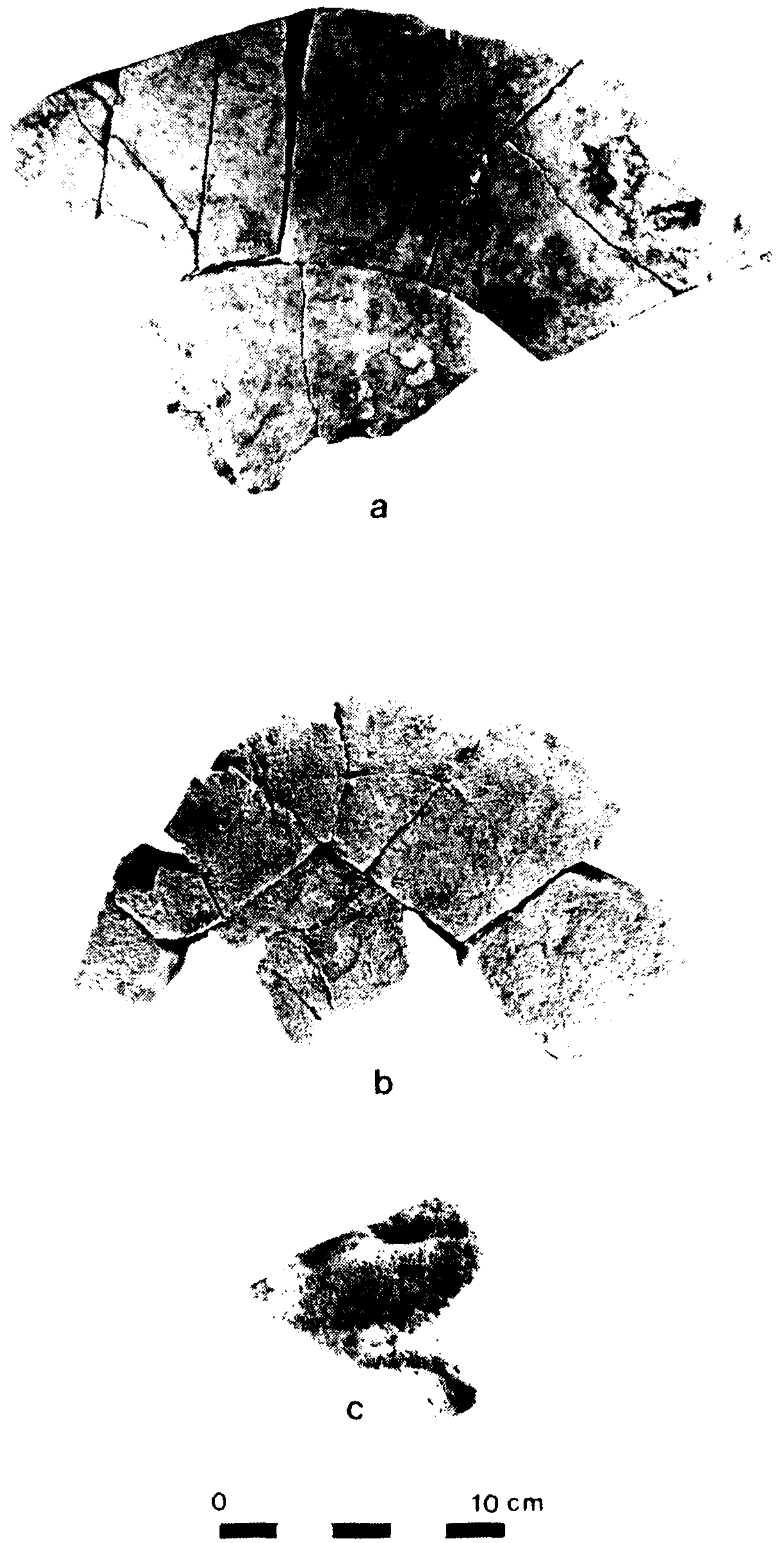


Figure 17. Ground stone tools from 23JA143. a-b, metates; c, abrader.

FAUNAL REMAINS

The faunal assemblage from 23JA143 consists of 5905 complete and fragmentary bones and teeth. The majority of these (n=3897) were recovered from the flotation and water screening and consist of small unidentifiable fragments. The sample from the general excavation includes 2008 specimens of which 251 were identifiable (Table 18). Two additional bones recovered from the flotation samples were identifiable (Table 18). The unidentifiable remains are predominantly small broken splinters of long bones from medium-sized mammals, probably deer, which spirally fractured and shattered during butchering and processing. The articular surfaces of most long bones are fractured from the diaphysis. Except for juvenile specimens which are less densely ossified and friable, the bone was well preserved, due to a favorable sediment chemistry. The absence of split-line cracks, or exfoliation, indicates a rapid post-depositional burial. A large number of bone fragments have been burnt.

The faunal identifications were made using the comparative collections at the University of Kansas Museum of Natural History. Data recorded included the species, the element, right or left side of body, a brief description of parts preserved and any evidence of butchering and processing. Determination of minimum numbers of individual (MNI) was based on multiple occurrences of a single element or age differences definable primarily on the basis of dentition. Based on these considerations, a minimum of nine deer and single individuals of other taxa are represented (Table 18). Except for a single avian element, all bones identified were those of mammals. Deer is the most commonly represented species comprising 92.8 percent of the fauna. Bison, wolf, raccoon and skunk share an equally small representation of the assemblage. There was an absence of rodents, lagomorphs, reptiles, amphibians and fish which are common constituents in many midwestern archaeological sites.

Odocoileus virginianus (white-tailed deer) MNI=9

A total of 235 elements were identified as those of deer. A minimum of nine individuals was indicated by the presence of nine distal left astragali. Most skeletal elements were present, but long bones were represented chiefly by their articular surfaces (Table 19). Ribs and vertebrae were scarce. White-tailed deer are inhabitants of open brushy areas, woodlands, and wooded banks of rivers and streams.

Deer teeth were represented by 56 complete and fragmentary specimens which were articulated to form 17 sets of right or left, upper (maxillary) or lower (mandibular), or mixed dentitions of single individuals. The presence of only seven left upper first molars (M^1) suggests that some of these sets may also be from the same individual. The dentitions were aged according to the eruption and wear sequences

Table 18. Identified faunal remains from 23JA143.

SPECIES	NUMBER OF FRAGMENTS	MINIMUM NUMBER OF INDIVIDUALS (MNI)
<u>Odocoileus virginianus</u> white-tailed deer	235	9
<u>Bison bison</u> bison	7	1
<u>Canis lupus</u> gray wolf	5	1
<u>Procyon lotor</u> raccoon	4	1
<u>Mephitis mephitis</u> striped skunk	1	1
<u>Bonasa umbellus</u> ruffed grouse	1	1
TOTAL	253	14

established by Severinghaus (1949). From Table 20, it is apparent that butchered deer remains from 23JA143 are bimodally distributed, with most deer aged either 13 to 20 months or 66 months. Whether this represents the selectivity by the occupants of this site for deer of a specific age class or is biased in some other way is unclear.

Table 19. Frequency of <u>Odocoileus virginianus</u> elements recovered from 23JA143.

ELEMENT	FREQUENCY	ELEMENT	FREQUENCY
Cranium	10	Hind Limb	
Mandible	5	Pelvis	6
Antler	1	Femur	6
Dentition	56	Tibia	6
		Fibulare	3
Vertebrae	2	Pes	
Thoracic	6	Astragalus	14
Lumbar	3	Calcaneum	15
Unidentified	1	Cubonanicular	8
Ribs	2	Metatarsal	8
Fore limb		Phalanges	
Scapula	4	Proximal	14
Humerus	4	Medial	9
Radius/Ulna	21	Distal	6
Manus		Metapodial	9
Metacarpal	11		
Carpal	7		

Table 20. Frequency of Odocoileus virginianus cheek teeth sets by age class.

AGE CLASS	UPPER (MAXILLARY)	LOWER (MANDIBULAR)	TOTAL
13-17 months	3	-	3
about 17 months	1	2	3
17-20 months	-	2	2
30 months	1	-	1
42 months	1	-	1
48 months	-	1	1
66 months	3	1	4
72 months	-	1	1
78 months	1	-	1
TOTALS	10	7	17

One specimen from 23JA143, which retains three milk molars dm^1-dm^3 and has a slightly worn M^1 and unworn M^2, corresponds to a deer aged 13 to 17 months. Assuming a fawning period of late May or early June (Bee et al. 1981), the deer was hunted between June and November. An October-November kill date is supported by five additional specimens aged at about 17 months. Ryel et al. (1961) reported that Michigan game biologists have lacked consistency in the use of the Severinghaus system and have underaged 54 month and older deer and overaged 5 month fawns, 18 month and especially 30 month old deer. If the youngest specimens from 23JA143 were overaged, a kill date in September or October would be indicated.

A partial skull of a large deer from 23JA143 was severely crushed over the fronto-parietal suture producing a deep depression on an area which is normally convex. The damage appears to have been caused by multiple blows with a heavy blunt object, perhaps in an attempt to sever the antlers which are missing below the line of abscission (burr). The deer was probably killed between April or May, when antlers begin to grow, and the following February, when antlers are normally shed, and even more likely after August when the velvet is lost (Walker et al. 1975).

Bison bison (bison) MNI=1

Several skull fragments including a complete basisphenoid, two wide crescentic enamel fragments, and a right squamosal with glenoid fossa and mastoid process, indicate the presence of a single individual. Additional remains tentatively referred to B. bison include three fragments of ribs and a partial vertebra. Bison are a grassland-adapted species whose herds numbered in the millions on the North American prairies. Smaller groups inhabited open woodlands in eastern Kansas and western Missouri.

Canis lupus (gray wolf) MNI=1

Gray wolf remains were represented by the distal end of a left humerus, a left os coxae, an atlas and two lumbar vertebrae. Of North American members of the genus, Canis latrans (coyote) is small, C. niger rufus (red wolf) and C. familiaris (dog) are intermediate and about equal in size and C. lupus (gray wolf) is large. Although wolf and dog overlap slightly in size, the largest Indian dogs reported by Gilbert (1969) and Haag (1948) are much smaller than the average wolf. As Table 21 indicates, canid specimens from 23JA143 are approximately the same size as an adult male gray wolf from Ontario and substantially larger than an adult male red wolf from Texas and an adult male domesticated dog from New Mexico. The gray wolf inhabited prairie and forested regions.

Procyon lotor (raccoon) MNI=1

Raccoon remains include one right mandible with P_2-M_2 preserved, one edentulate right maxilla, a distal end of a right humerus, and several skull fragments including the petrous temporal. The raccoon is common in western Missouri, inhabiting woodlands and woodland-grassland ecotones, especially near water.

Mephitis mephitis (striped skunk) MNI=1

A single left ulna of Mephitis was recovered. The striped skunk is most abundant in mixed woodland and grassland habitats such as forest edges, wooded ravines and rocky outcrops.

Bonasa umbellus (ruffed grouse) MNI=1

Two fragments of a left carpometacarpus were identified as Bonasa umbellus. The proximal and distal elements probably represent the same individual, although this is difficult to determine since much of metacarpal II and all of metacarpal III are broken and lost. Both fragments have been burnt. The proximal fragment exhibits the same form and orientation of the pollical facet and the metacarpal and pisiform processes as in other gallinaceous birds, and there are similar distinct sulci separating the anterior carpal fossa and the pisifform process from the process of metacarpal I. The fragments agree most closely in size with the ruffed grouse, being much larger than either bobwhite (Colinus virginianus) or scaled quail (Callipepla squamata) and somewhat smaller than the greater and lesser prairie chickens (Tympanuchus cupido and T. pallidicinctus) and the sharp-tailed grouse (T. (Pedioecetes) phasianellus), all of which were former residents or vagrants in the Midwest.

Ruffed grouse were residents in eastern Kansas and western Missouri prior to its settlement, but being an inhabitant of woodlands its distribution was confined to the timber bordering the streams. With the removal of the forest undergrowth came the extirpation of the species from much of their former south central range. Ruffed grouse are now found chiefly in the eastern and northern United States and Canada.

Butchering and Processing

Information concerning Middle Archaic butchering, processing and

procurement strategies is provided by the distribution of skeletal elements and butchering marks. Thirteen of the 235 identified deer elements exhibit cuts and striations resulting from skinning and butchering. All of the identified cut marks occur on elements of the extremities. Shallow cuts are present on the axillary margin of two scapulae and on the distal end of one humerus above the lateral epicondyle. Several shallow incisions are also noted above the coronoid process on one ulna. Numerous deep cut marks were made below the proximal end of a radius on its lateral side. Shallow to moderately deep striations are present above the lateral trochlea on one metacarpal, and above the distal intermetacarpal foramen on a second metacarpal.

Table 21. Comparison of canid elements from 23JA143 with wolves and dog.

	23JA143	*Canis lupus* (Gray wolf) KUMNH 18766*	*C. niger rufus* (Red wolf) KUMNH 14879	*C. familiaris* (Dog) KUMNH 7038
ATLAS:				
Breadth across cranial cotylae	47.9	47.4	41.8	39.7
Sagittal length of dorsal arch	11.7	11.4	10.4	8.0
Breadth across dorsal foramina	38.0	34.2	29.4	31.1
HUMERUS:				
Breadth across epicondyles	39.9	42.6	32.7	33.9
Breadth of distal articular surface	27.8	28.8	21.5	23.3
OS COXAE:				
Supero-inferior diameter of acetabulum	25.0	27.1	21.2	22.9
Least breadth of ischial ramus	22.9	20.0	16.0	17.4
Least breadth of ilium	23.1	23.2	21.3	18.0

*KUMNH=Kansas University Museum of Natural History Specimen Number

Two deep cuts are present on the lateral side of the patellar tuberosity on one tibia. Evidence of cut marks are quite numerous on the calcanea. While one calcaneum has a few incisions below the fibular facet, a deep gash above the cuboid facet, and six or more deep cuts above the sustentaculum tali, two other specimens have only a few shallow to moderately deep incisions either lateral or anterodistal to the caleaneal tubersoity. A fourth calcaneum has a deep cut over the groove for the flexor hallucis longus. The medial surface of one astragalus bears three or four moderately deep striations.

The cut marks on the Odocoileus scapulae were probably produced when the infraspinatus and subscapularis muscles were cut to separate the forelimb from the shoulder. Cuts on the humerus, radius and ulna may have occurred when the extensor carpi radialis, extensor digitalis lateralis, triceps brachii and fibrous capsule were incised to disarticulate the brachium and antebrachium. The incisions on the metacarpi were probably produced during skinning, since this is a convenient area to detach the hide; these may also indicate an effort to sever the digital extensor tendons in order to remove the phalanges.

Only the heads and condyles of the femora are present in the assemblage. The diaphyses of the femora and all the long bones are broken and splintered, probably resulting from marrow extraction. It seems likely that, in separating the rear extremity from the pelvis, the neck of the femur was smashed while that bone was still articulated, leaving the head undamaged. Cut marks on the tibia probably occurred when cutting the quadriceps femoris tendon and possibly the tibialis anterior muscle; they may also have been produced during skinning, as the sharp anterior border of the tibia is subcutaneous. It appears as though the pes was disarticulated by cutting through the tendo calcaneus, digital extensors, peroneal musculature and lateral ligaments overlying the calcaneum and astragalus, rather than over the distal end of the tibia. The cut over the sustentaculum tali would have severed the tendon of flexor hallucis longus and the overlying flexor digitalis (longus and profundus) and tibialis posterior, thus rendering the foot lax.

The frequency of occurrence of the various elements indicates that the deer were butchered and processed at the site. Although most elements of the skeleton are present. The most numerous elements are from the skull and lower parts of the extremities. The butchering marks and the distribution of elements indicates that the carcass was transported to the site, possibly quartered and then butchered into smaller more manageable portions.

The presence of limited bison remains consisting of skull fragments and ribs indicates that the carcass was probably fleshed some other site. A single bison rib also exhibits evidence of gnawing. These marks are tightly packed striations on both the superior and inferior borders. The thin linear grooves indicate that they were made by one or more rodents scavenging the refuse at the site. A few very shallow striations appear on the raccoon humerus anteriorly above the entepicondylar foramen. Although not conclusive, this suggests that the raccoon also had been butchered.

FLORAL REMAINS

A total of 18 carbonized seeds and 96 carbonized nutshell fragments were recovered from the buried Middle Archaic component at 23JA143. The following discussion has been based on Steyermark's Flora of Missouri (1963) for information concerning the species present in the area and their preferred habitats. Much of the information concerning methods of seed dispersal and season of nut and seed availability was supplied by Ralph Brooks.

Carbonized Seeds

The 18 identifiable carbonized seeds represents four taxa (Table 22).

Amaranthus sp. (amaranth) n=6

Six carbonized amaranth seeds were recovered. Amaranths or pigweeds are annual herbaceous plants frequently found in disturbed areas. Seven native species are common in Jackson County (Steyermark 1963). Included are mesic-adapted species found in lowland environments and xeric-adapted species found in waste areas. Most are short broad bush-like plants up to 1 m in height that can produce several thousand seeds. The seeds of amaranths are available in late August through October. Amaranth seeds are small and light and are easily blown about and washed by rains.

Ammannia sp. (ammania) n=1

One ammania seed was recovered. Ammania is a small annual plant, 20-25 cm in height, which produces small capsules of seeds. According to Steyermark (1963), *A. auriculata* (ammania) and *A. coccinea* (tooth-cup) occur in Missouri. The latter is the most common and widespread. It is found on the muddy margins of slow streams, ponds and sloughs. Each plant produces hundreds of seeds which are available in late August through October. They could be easily collected by gathering the plants before the capsules break. The seeds are light and could be blown on the ground or washed about by rains or flooding.

Chenopodium sp. (goosefoot) n=7

Seven chenopod seeds were recovered. According to Steyermark (1963), 17 species of *Chenopodium* presently occur in Missouri. However, only three native species are fairly common. *C. standleyanum* (goosefoot) occurs in dry or moist soil, shaded woodlands, thickets, rocky or rich ground, ledges or bluffs. *C. album* (lamb's quarters) occurs in waste and cultivated ground. *C. hybridum* (maple-leaf goosefoot) occurs in rich open soils, woodlands, along shaded ledges, slopes and bluffs. Chenopods are annual plants, 60-100 cm in height, which have flowers and fruits in thick spikes. Thousands of seeds, which are available from September through October, are produced by each plant. Chenopod seeds drop to the ground but are easily moved about by wind and water.

Portulaca sp. (purslane) n=4

Four purslane seeds were recovered. Two species, *P. oleracea* and

P. mundula, are native to Jackson County. Purslanes are short upright mat-forming succulents 5-13 cm in height that occur in cultivated and waste ground and in rocky escarpments along bluffs (Steyermark 1963). Purslane seeds are borne in capsules from August through October. Each plant can produce several hundred seeds which are scattered on the ground by wind and water. P. oleracea was initially a tropical resident that has been carried north at some point in the past (Brooks: personal communication).

Table 22. Carbonized floral remains from 23JA143.

	FEATURES	GENERAL EXCAVATION	TOTAL
SEEDS			
Amaranthaus sp. amaranth	5	1	6
Ammannia sp. ammania	1		1
Chenopodium sp. goosefoot	2	5	7
Portulaca sp. purslane	1	3	4
Total	9	9	18
NUTS			
Juglans nigra black walnut	18	11	29
Carya sp. hickory nut	6	5	11
Unidentified Nuts	34	22	56
Total	58	38	96
TOTAL	67	47	114

Carbonized Nutshells

Carbonized nutshells recovered from 23JA143 include 40 identifiable and 56 unidentifiable fragments (Table 22). Two taxa including hickory nuts (Carya sp.) and black walnuts (Juglans nigra) were recovered.

Carya sp. (hickory) n=11

Eleven hickory nut fragments were recovered. Six species of hickory are present in Jackson County (Steyermark 1963). Included are species which occur in mesic lowland settings and species which occur in zeric upland woods. Hickory nuts are available from September through October (Stephens 1973) and were eaten widely throughout aboriginal

North America (Yanovsky 1936). In many instances they were gathered in the fall and stored for winter use.

Juglans nigra (black walnut) n=29

Twenty-nine fragments of black walnut shell were recovered. This species occurs in rich woods at the base of slopes or bluffs, in valleys along streams and in open and upland woods (Steyermark 1963). The nuts are available in October (Stephens 1973).

The composition of the carbonized seed and nutshell remains from the Middle Archaic deposits at 23JA143 indicate a fairly narrow emphasis on the utilization of slope and lowland floral resources, rather than a broader usage of resources from both upland and lowland environments. The four herbaceous plant species represented are generally found in disturbed or edge lowland environments, while the mast producing species represented are riparian and slope forest adapted.

The availability of these species as shown in Table 23 is evidence of a late summer and fall occupation of the site. All of the species represented in the carbonized floral remains are available sometime during the period of late August through the end of October.

DISCUSSION AND SUMMARY

23JA143 is a stratified Middle Archaic and Middle Woodland occupation located on the T-1 terrace of the East Fork of the Little Blue River. Test excavations at the site in 1976 and 1979 identified a shallowly buried Middle Woodland component in the upper T-1 terrace deposits just below the cultivation zone. Further excavations in 1983 indicated that only isolated artifacts associated with the Middle Woodland component remained. Additional testing in the fall of 1983 resulting in the discovery of a deeply buried Middle Archaic cultural stratum eroding from the cutbank of the Little Blue River along the western edge of the site. This deposit consisted of a buried living floor containing well preserved features and organic remains. Excavations in 1984 were focused on obtaining a sample of features, lithics and faunal and floral remains with the objective of reconstructing the Middle Archaic activities that took place at the site.

The stratigraphy of the T-1 terrace fill at 23JA143 consists of three major depositional units referred to as Units A, B and C. The lower two units (Units A and B) are capped with paleosols evidencing periods of depositional stability on the floodplain of the Little Blue River. Both units are fine-grained alluvial deposits representing overbank floodbasin deposits. The upper Unit C sediments are recent levee deposits capping Unit B and the Middle Woodland component.

The Middle Archaic cultural deposit consists of a thin stratum of cultural debris approximately 30 cm in thickness located at a depth of

Table 23. Seasonal availability of floral resources recovered from 23JA143.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG		OCT	NOV	DEC
Amaranthus sp.								---	---	---		
Ammania sp.								---	---	---		
Chenopodium sp.									---	---		
Portulaca sp.								---	---	---		
Carya sp.									---	---		
Juglans nigra										---		

3.0-3.4 m below the surface in the 3ACgb soil horizon of Unit A. Evidence of the cultural deposit extends along the cutbank of the Little Blue River for a distance of approximately 30 m. The cultural zone contained flecks of charcoal and burnt sediment scattered from hearths along with chipped stone tools, lithic manufacturing debris and discarded animal bones. Two radiocarbon dates of 6600±100 and 6580±120 years B.P. indicate a chronological placement in the early Middle Archaic period.

The projectile points from the Middle Archaic component consist of small side-notched dart points with thin lenticular cross-sections. These points are similar to those from a number of early Archaic sites in the eastern Prairie Plains. The closest sites include the Coffin site, also located along the Little Blue drainage (Reeder 1977), and the Hyde site located in the Melvern Lake area of east central Kansas (Schmits and Donohue 1984). Better known sites representative of this cultural tradition include the Logan Creek site (Kivett 1963) in eastern Nebraska and the Cherokee Sewer site in western Iowa (Anderson 1980).

The assemblage from 23JA143 appears to be most similiar to the assemblage from Horizon I at the Cherokee Sewer site which is dated at 5950±82 to 6380±90 years B.P. (Anderson 1980). Dates from the Logan Creek Site range from 8025±250 to 6065±300 years B.P. (Kivett 1963). The Hyde Site has a thermoluminescence date of 6370±18 percent B.P. (Schmits and Donohue 1984). Another diagnostic tool from both the Hyde and Logan Creek sites is a side-notched stemmed bifacial scraper. Some of these appear to be made from reworked scrapers, while others appear to have been initially used as scrapers.

The assemblage from 23JA143 and the Coffin site are typologically comparable and appear to represent a single cultural unit designated as the Blue Springs phase. The Blue Springs phase is primarily characterized by small side-notched dart points. The small side-notched stemmed scrapers present at both the Logan Creek and Hyde sites are not present at the Blue Springs phase site. Another distinctive stylistic feature of the formal chipped stone tool assemblage from the Blue Springs phase component at 23JA143 is the tendency toward the production of small bifaces. This tendency is evident throughout the assemblage beginning with the blanks and continuing through the reduction sequence to preforms, knives, and projectile points.

A total of 12 cultural features were recovered from the Blue Springs phase component at 23JA143. Included are five hearths, five lithic knapping stations and two refuse areas. The hearths included Features 2, 3, 5, 7 and 10. A large hearth (Feature 7) and two small hearths (Features 2 and 5) were located within a large light scatter of burnt earth and charcoal on the northern end of the excavations, suggesting all were part of a large campfire area with Feature 7 as the main fire. A small hearth (Feature 3) was located between two lithic knapping stations near the center of the excavation. Another large hearth (Feature 10) was located in the southwestern corner of the block. A small knapping station (Feature 9) was located within this feature. Feature 12, another knapping station is located to the east. The absence of hearthstones, the size and shallow depth of the hearths

suggest that the hearths were fairly short-term surface fires used primarily for cooking.

The lithic knapping stations included Features 1, 4, 8, 9, and 12. Feature 1 was a large knapping area that contained decortication flakes in addition to a large percentage of intermediate flakes and bifacial trimming flakes. Several cores and broken bifaces were found in the feature or nearby suggesting they were discards from tool production at the feature. Feature 12 was a large knapping area that also produced some cortical chert, however the high numbers of intermediate and bifacial trimming flakes indicate that the final stages of biface production took place there. Tool maintenance was also indicated by the presence of a number of resharpening flakes. Several cores, biface fragments and tools found in or adjacent to Feature 12 may represent broken tools or discarded raw materials associated with tool production at the feature.

The Feature 4, 8 and 9 knapping stations all contain types of debitage suggesting that cores were initially reduced elsewhere and brought to these areas probably as blanks and then further reduced. Feature 8 is the largest of these knapping stations. In addition to manufacturing debris, two broken tools with use-wear recovered from the feature suggest they were broken during resharpening. Both this feature and the small lithic concentration at Feature 4 were likely associated with the Feature 3 hearth. Feature 9 is a small knapping station located in a large hearth. The debitage is unburnt and appears to have been deposited after the hearth was utilized.

The refuse areas recorded as features include Feature 6, a small concentration of lithics, bone, charcoal and burnt clay which appears to be a secondary deposit of lithic manufacturing debris, food refuse and hearth cleaning debris. It is associated with the large Feature 7 hearth. The Feature 11 refuse area was located several meters north of the block excavation along the cutbank of the Little Blue River.

The chipped stone tools from the buried Blue Springs phase component at 23JA143 include ten projectile points, a drill, seven bifacial knives, 13 preforms, 27 blanks, 26 biface fragments, 30 scrapers, a graver and 101 informal edge-modified tools. Almost half of the formal tools exhibit abrasive use-wear (Table 24). A total of 23 tools have cutting wear including eight with heavy-duty cutting wear and 15 with general cutting wear. All six of the projectile points sufficiently complete for use-wear analysis exhibit cutting wear. Five knives, three blanks, four biface fragments and two flake scrapers also exhibit cutting wear. Thirty-three tools exhibit scraping wear including 21 with general scraping wear, four with heavy-duty scraping wear and eight with light-duty scraping wear. Most of the scraping wear is located on scrapers, although three bifacial blanks and four fragments also have scraping use-wear. The single graver exhibits graving/incising wear. A total of 36 tools with use-wear (63 percent) have general cutting or scraping wear indicating use on both hard and soft materials. Thirteen (22.8 percent) have heavy-duty wear indicating use on hard materials such as bone, antler or hardwoods and eight (14.0

percent) have light-duty wear indicating use on soft materials.

Table 24. Use-wear modifications on formal tools from 23JA143.

TOOL CLASS	WEAR TYPE* GC	HDC	GS	HDS	LDS	GI	TOTAL MODIFICATIONS	TOTAL TOOLS
Projectile Points	5	1					6	10
Bifacial Knives	1	4					5	7
Preforms							–	13
Drill		1					1	1
Bifacial Blanks	3		2	1			6	27
Biface Fragments	4		3	1			8	26
Unifacial Scrapers			4		3		7	8
Flake Scrapers	2	2	12	2	5		23	22
Graver						1	1	1
TOTAL	15	8	21	4	8	1	57	115

*GC=General Cutting, HDC=Heavy Duty Cutting, GS=General Scraping, HDS-Heavy-Duty Scraping, LDS=Light-Duty Scraping, GI=Graving/Incising

Based on the range of tool types, use-wear characteristics and the lithic manufacturing debris and minerals present, it can be inferred that the following activities occurred during the Middle Archaic occupation at 23JA143: hunting (projectile points, impact fractures); butchering (bifacial knives, cutting use-wear); hide-working (scrapers, light-duty scraping wear); hardwood, bone or antler working (graver, heavy-duty cutting, scraping and incising use-wear); chipped stone tool manufacture and maintenance (cortical, intermediate and bifacial trimming flakes); pigment production (hematite and limonite) and processing of vegetal material (metates).

The overall frequences of debitage recovered from the site indicate that the full range of the lithic reduction occurred there. However, the frequencies of cores, chunks and shatter are relatively low, indicating initial reduction primarily occurred elsewhere. As noted above, one of the most distinctive features of the assemblage is the tendency toward the production of small bifaces. This is reflected in the frequency of smaller pieces of lithic manufacturing debris as evidenced by the high percentage of chips, which represent 64.7 percent of the debitage.

Utilization of chert resources by the Middle Archaic inhabitants of 23JA143 was limited to locally available cherts. With the exception of a single piece of Westerville chert, the entire chipped stone assemblage consists of Winterset chert. Almost all of the Winterset chert is the gray variety common in the Blue Springs Lake area. A small amount is brown Winterset which outcrops to the south of the Blue Springs area. Although not local to the Blue Springs area, Westerville chert is a

Kansas City Group chert that outcrops in southern Clay County less than 16 km from 23JA143 (Reid 1980b).

Evidence for heat treatment of the chipped stone tool assemblage is virtually absent. Only one tan Winterset chert biface fragment has been heated. The debitage is also almost entirely unheated. Only a few pieces of shatter exhibit evidence of heating and these could have been inadvertently dropped into a hearth.

Based on the faunal remains present, the occupants of 23JA143 focused their hunting activities in forested and open wooded areas. It seems that minimal use was made of aquatic or prairie environments. Hunting appears to have consisted of a specialized procurement and processing of deer although at least one bison is present. Other smaller mammals, including raccoon, wolf, and bison, were probably fortuitously obtained. The age distribution of the deer butchered at the site points to occupation of the site in the fall. The cut marks and the elements recovered indicate that the deer were butchered at the site. Butchering marks indicate that the carcass was skinned, disarticulated and fleshed. The raccoon was probably also butchered at the site. Despite the absence of cut marks, the wolf was probably hunted for its pelt. The presence of bison skull fragments and absence of limb elements suggests that the animal was processed at 23JA143 after being transported in small portions from some other locality.

The species of fauna present in the assemblage indicates that the environment in the vicinity of 23JA143 was predominantly open woodlands. The deer, raccoon and striped skunk can be found in both woodlands and in forest edge environments. Wolf and bison occurred in prairies and in open woodlands. Wolves also inhabited forests. Ruffed grouse were restricted to forested areas with dense undergrowth.

The floral assemblage from 23JA143 indicates that gathering efforts were focused on slope and lowland environments. Minimal usage was made of upland forest or prairie floral resources. The season of availability of the plant resources also suggests a late summer to fall occupancy of the site.

Spatial Analysis

The buried Blue Springs phase occupation at 23JA143 consisting of a sealed-in living floor provides an opportunity to investigate the spatial distribution of activities that took place at a Middle Archaic site. Field observations indicated the presence of concentrations of debris and clusters of artifacts surrounding the features. However, initial mapping of the assemblage indicated that the boundaries between the concentrations were indistinct and that clusters of artifacts appeared to overlap. In order to further investigate the internal structure of the site, Venn diagrams were drawn around clusters of each artifact class that was individually mapped. This included the chipped stone tools, cores and ground stone tools. The results indicated the presence of series of superimposed clusters of different artifact types. The perimeters of areas with multiple overlapping clusters form four

recognizable debris scatters which encompass nearly all of the tools recovered from the excavation (Figure 12).

Area I principally consists of a large cluster of edge-modified debitage located southeast of Feature 7, the large hearth near the northern end of the excavation. Area II consists of a large cluster of tools and cores located in the west central part of the excavation between the Feature 1 knapping station and the superimposed Feature 9 knapping station and the Feature 10 hearth. Area II is primarily defined by a large scatter of blanks and preforms with a smaller scatter of scrapers, edge-modified debitage and points also present. Two broken blanks and two broken cores from Area II cross-mend.

Area III is located near the center of the excavation and consists of a scatter of tools around and extending to the southeast of the Feature 3 hearth and the Feature 7 knapping station. Area III is essentially defined by two overlapping areas of edge-modified debitage and biface fragments. Two small clusters of scrapers are also present. Area IV is a large concentration of tools and cores located in the southeast corner of the excavation southeastern of the Feature 11 knapping station. Area IV is essentially defined by the perimeter of a large cluster of blanks, preforms and points. Smaller clusters of biface fragments, scrapers, edge-modified debitage and cores are also present. Two blanks, two preforms and two bifacial knives within Area IV cross-mend.

In general, the distribution of the mapped tools and cores indicate a series of clusters of debris surrounding and adjacent to the hearths and knapping stations. Areas II and III near the center of the excavation encompass both hearths and knapping stations. Area I near the northern edge of the excavation is located near a hearth, while Area IV near the southeastern corner of the excavation is located near a knapping station. Two ash scatters near the southeastern edge of the excavation may indicate that a hearth was located outside of the area excavated near Area IV.

The association of these debris scatters with features such as hearths and knapping stations suggests that they might represent either individual family areas or a consecutive series of individual work areas if the site were occupied over a longer period of time. In order to explore these alternative explanations in more detail, further intrasite analysis was conducted by comparing frequencies of tool types and use-wear present and the presence of faunal remains and debitage in the individual areas.

Activity Area I: As noted above, Area I consists of a scatter of edge-modified flake tools approximately six sq m in extent located to the east and southeast of a large hearth (Feature 7) at the northern end of the excavation. Artifacts located in Area I include 27 chipped stone tools, one core, 36 unworked stone fragments and four identified animal bones (Table 25). The tools include one projectile point, two preforms, one blank and 23 edge-modified tools. The small number of identifiable faunal remains are all white-tailed deer.

The small number of formal tools from Area I exhibit no use-wear,

however a total of 22 edge-modified tools have use-wear. Three have heavy-duty cutting wear, six have light-duty cutting wear, seven have heavy-duty scrapping wear, four have light-duty scraping wear, one has graving-incising wear and one has boring/piercing wear (Table 27). A total of nine tools were used for cutting and 11 for scraping. Eleven of the tools were utilized on hard materials and 11 on soft materials. The presence of a large number of expedient edge-modified tools and the use-wear on these tools suggest that wood whittling around a campfire occurred in Area I.

Activity Area II: Area II consists of a large cluster of tools, lithic manufacturing debris and animal bone about seven sq m in extent surrounding the Feature 1 knapping station and extending south to the superimposed Feature 10 hearth and Feature 9 knapping station. Artifacts from Area II include 49 chipped stone tools, a metate, nine cores, a mineral stain, 59 small pieces of unworked stone and 104 identified animal bones (Table 25). Formal chipped stone tools include two projectile points, a bifacial knife, a preform, ten blanks, three biface fragments and 13 scrapers. The identified faunal remains include 101 deer elements and single bison, raccoon and skunk elements. Eighteen of the 30 formal tools exhibit use-wear including five with general cutting wear, one with heavy-duty cutting wear, six with general scraping wear, one with heavy-duty scraping wear and five with light-duty scraping wear (Table 26). The edge-modified tools include four with heavy-duty cutting wear, four with light-duty cutting wear, three with heavy-duty scraping wear, eight with light-duty scraping wear, one with graving-incising wear and one with boring/piercing wear (Table 27). Overall 14 tools from Area II have cutting wear, 23 have scraping wear, one has graving/incising and one has boring/piercing wear. A total of ten tools have use-wear indicative of working hard materials, such as hardwoods, bone or antler, while 18 were used on softer materials, such as meat or hides. Eleven tools were used on both hard and soft materials.

Several activities appear to have taken place in Area II resulting in superimposed clusters of debris. Chipped stone tool production is indicated by the lithic manufacturing debris in Features 1 and 9, while butchering is indicated by the bifaces exhibiting abrasive cutting wear and by cutmarks on some of the bones. Hide scraping is indicated by the large number of scrapers and edge-modified tools that exhibit light-duty scraping wear. Many of these scrapers have highly polished and rounded edges that can clearly be associated with hide working. Food preparation is indicated by the Feature 10 hearth, by the dense scatter of deer bones and by the presence of a broken metate. Mineral processing is indicated by the limonite stained soil.

Activity Area III: Area III is a small area approximately four sq m in extent surrounding the Feature 8 lithic knapping station and the Feature 3 hearth. Feature 8 is a large knapping station which contained a high percentage of bifacial trimming flakes and 16 edge-modified flakes. Artifacts from Area III include seven biface fragments, eight scrapers, two cores, 28 edge-modified tools, two small unworked stone fragments

Table 25. Recovered materials from activity areas at 23JA143.

	ACTIVITY AREA I	II	III	IV	TOTAL
Projectile Points	1	2		6	9
Knives		1		6	7
Preforms	2	1		10	13
Blanks	1	10		13	24
Bifacial Fragments		3	7	12	22
Scrapers		13	8	8	29
Graver				1	1
Cores	1	9	2	4	16
Modified Debitage	23	19	28	24	94
Ground Stone Tool		1			1
Minerals		1		6	7
Unworked Stone	36	59	2	26	123
Identified Bone	4	104	6	17	131
TOTAL	68	223	53	133	477

Table 26. Summary of formal tool use-wear by activity area at 23JA143.

WEAR TYPE	ACTIVITY AREA I	II	III	IV	TOTAL
General Cutting		5		9	14
Heavy-Duty Cutting		1		5	6
Light-Duty Cutting					0
General Scraping		6	6	7	19
Heavy-Duty Scraping		1	1	2	4
Light-Duty Scraping		5	2	1	8
Graving/Incising				1	1
Boring/Piercing					0
TOTAL	0	18	9	25	52

Table 27. Summary of edge-modified tool use-wear by activity area at 23JA143.*

WEAR TYPE	ACTIVITY AREA I	II	III	IV	TOTAL
Heavy-Duty Cutting	3	4	1	5	13
Light-Duty Cutting	6	4	6	7	23
Heavy-Duty Scraping	7	3	6	7	23
Light-Duty Scraping	4	8	13	5	30
Graving/Incising	1	1		1	3
Boring/Piercing	1	1	2	2	6
TOTAL	22	21	28	27	98

*Numbers indicate utilized edges, not tools.

and six identified bones (Table 25). Four of the bones are deer, one is bison and one is raccoon. Use-wear on the formal tools includes six tools with general scraping wear, one with heavy-duty scraping wear and two with light-duty scraping wear (Table 26). The edge-modified tools include one with heavy-duty cutting wear, six with light-duty cutting wear, six with heavy-duty scraping wear, 13 with light-duty scraping wear and two with boring/piercing wear (Table 27). A total of 23 tools were used on soft materials, eight on hard materials and six on both hard and soft materials. A total of 28 were used for scraping, seven for cutting and two for boring/piercing.

Based on the features and artifacts present, Area III appears to be a hide-working area adjacent to a lithic knapping station. Discarded flakes from the knapping station were used along with formal scraping tools to cut or pierce hides. Both of these activities took place to the east and southeast of a small hearth.

Activity Area IV: Area IV is a triangular area about 12 sq m in extent encompassing a large lithic knapping station (Feature 12). Artifacts from Area IV include 56 formal tools, 24 edge-modified tools, four cores, six minerals, 26 small pieces of unworked stone and 17 identified faunal elements (Table 25). The formal tools included six projectile points, six knives, ten preforms, 13 blanks, 12 biface fragments, eight scrapers and a graver. The faunal remains include 14 white-tailed deer elements and two wolf elements.

Use-wear analysis of the formal tools from Activity Area IV indicates that nine have general cutting wear, five have heavy-duty cutting wear, seven have general scraping wear, two have heavy-duty scraping wear, one has light-duty scraping wear and one has graving/incising wear (Table 26). The edge-modified tools include five with heavy-duty cutting wear, seven with light-duty cutting wear, five with light-duty scraping wear, one with graving/incising wear and two

with boring/piercing wear (Table 27). Twenty-six tools were used for cutting. Scraping wear is present on 22 tools, graving/incising wear on two and boring/piercing wear on two. Twenty-one tools were used on hard materials, 15 on soft materials and 16 on both hard and soft materials. Area IV appears to be a multi-purpose activity area. The primary activity appears to have been deer butchering, as is indicated by the high frequencies of formal bifacial tools with abrasive cutting wear in association with deer bones. The faunal elements present are nearly all lower limb elements of deer that would have been discarded during butchering. Three of these bones exhibit cut marks. A second activity that took place in Area IV was the production, and maintenance of tools, as is indicated by the Feature 12 knapping station. The emphasis in lithic reduction at Feature 12 was on final stages of biface production, as is evidenced by large numbers of bifacial trimming flakes and by the high frequencies of preforms and blanks. Over 80 percent of these tools show no evidence of utilization and most are small or broken and appear to be rejects. Several biface resharpening flakes were present in the debitage analyzed as well as one uniface resharpening flake. The chipped stone tool production activities that occurred in Area IV were likely oriented toward the production and maintenance of butchering tools used there.

Although eight scrapers were recovered from Area IV, only one has light-duty scraping wear indicative of use in working hides. The remaining seven scrapers including five with general scraping wear, one with heavy-duty scraping wear, two with heavy-duty cutting wear and one with general cutting wear. Since half of the tools exhibit scraping wear indicative of use on both hard and soft materials materials, it is difficult to infer the activities represented by the cluster of scrapers in Area IV. The cutting of ligaments and removal of flesh by scraping from the lower limb elements might produce wear similar to that observed on the scrapers. The processing of minerals in Area IV is indicated by the six pieces of hematite. The presence of the minerals suggests that pigment processing may have occurred. Unworked stone including small fragments of sandstone, limestone and a piece of volcanic pumice were also recovered from Area IV.

Summary

The Blue Springs phase component at 23JA143 consists of a buried cultural stratum eroding from a cutbank of the Little Blue River. At the time of occupation, the site appears to have been located on the floodplain not far from the river channel. The cultural zone was about 30 cm in thickness and contained occupational debris and features such as hearths and chert knapping stations. Two radiocarbon dates of 6580±120 years and 6660±100 years B.P. have been obtained from the cultural deposit. Four major activity areas were defined. Area I appears to have been a light woodworking or bone working area located adjacent a hearth. Area II is located between a large chert knapping station and a second large hearth and appears to have been used for chipped stone tool production, butchering, hideworking and food preparation. Area III contained a small hearth and a large knapping station. Hideworking and chipped stone tool production appear to be the

major activities in Area III. Area IV appears to have been primarily used for deer butchering and the production of bifacial butchering tools. Mineral processing occurred there as well.

The projectile points from 23JA143 are small side-notched dart points made from subtriangular preforms with lenticular cross-sections and straight to concave bases. The notches and bases of have been ground. All exhibit use wear that generally can be attributed to the cutting of hard materials or a combination of both hard and soft materials. About half of the 115 formal chipped stone tools exhibit use-wear. The single graver present exhibits graving/incising wear. Use-wear indicative of cutting is present on about 40 percent of the tools, while about 58 percent exhibit wear resulting from scraping and almost 2 percent from graving/incising. About 23 percent of the wear resulted from working hard materials, 14 percent from soft materials and about 63 percent were used on both hard and soft materials.

Based on the range of tool types, use-wear characteristics and lithic manufacturing debris present, activities including hunting, butchering, hideworking, hardwood, bone and antler working, chipped stone tool manufacture and maintenance, pigment production and processing of vegetal materials took place at 23JA143. Utilization of chert resources at 23JA143 was primarily limited to locally available Winterset chert. Evidence of heat treatment is virtually absent. The debitage indicates that the full range of the lithic reduction sequence occurred there, however, the frequencies of cores, chunk and shatter are low, indicating that initial reduction primarily occurred elsewhere.

Faunal remains indicate that subsistence was focused on the procurement of deer. A minimum of nine individual deer are present, at least one bison was also present, as are single individuals of several smaller species including gray wolf, raccoon, striped skunk and ruffled grouse. Aging of the deer dental elements indicates an October to November kill date. Floral remains recovered include carbonized seeds such as amaranths, ammania, chenopods and purslane, although extremely small number are represented. A somewhat large number of nutshells including hickory and black walnut were also recovered.

In summary, 23JA143 consists of a residential camp, occupied for a relatively brief interval, such as a single season. This occupation probably occurred during the fall. Activity areas at the site consist of clusters of tools and debris located adjacent to hearths and chert knapping stations. It is likely that these were associated with individual nuclear families. The principal activities that took place at the site appear to have been the butchering and processing of deer and hideworking. The Blue Springs phase appears to be part of a broader early Middle Archaic cultural tradition that was fairly widespread along the Prairie Plains Border during the seventh millenia B.P. This cultural tradition was characterized by the use of small side-notched points and contrasts with Middle Archaic sites to the east, such as the Perche Creek site (Schmits 1985), Rodgers Shelter (Kay 1982) and Pidgeon Roost Creek (O'Brien and Warren 1982). These more easterly sites are characterized by the use of either larger side-notched points or a combination of side-notched and stemmed and corner-notched forms.

CHAPTER VI

THE COLD CLAY SITE (23JA155)

Larry J. Schmits

INTRODUCTION

The Cold Clay site (23JA155) is located near the headwaters of the East Fork of the Little Blue River (Figure 18). The site was first located and tested by the University of Kansas in the 1976 cultural resources survey and testing program at Blue Springs and Longview Lakes (Brown 1977). These test excavations identified cultural material to a depth of 80 cm below the surface. The only diagnostic artifact recovered was a contracting-stemmed point which suggested the presence of a Woodland component. Since the 1976 test excavations were inconclusive, further testing was recommended (Brown 1977).

The additional test excavations were conducted during the summer of 1979 by Soil Systems, Inc. (SSI) as part of a contract with the U.S. Army Corps of Engineers for mitigation of the archaeological resources at Blue Springs and Longview Lakes (Schmits and Reust 1982a). These investigations failed to relocate the Woodland component, but resulted in the discovery of a deeply buried Archaic component. Since the site was located in the right-of-way of the Blue Springs Interceptor Sewerline, further archaeological testing was conducted in December of 1979 for the Environmental Protection Agency (Schmits and Reust 1980). This work included backhoe trenching to define the southern and western limits of the site and soil-geomorphic investigations designed to determine the depositional sequence and soil stratigraphy of the site. Based on this work, realignment of the interceptor line to the south of the site was recommended.

The results of the combined U.S. Army Corps of Engineer and EPA funded work indicated the presence of a buried late Middle or transitional Middle-Late Archaic component at the site. The small sample of projectile points and radiocarbon dates suggested a possible relationship with either the Late Archaic Nebo Hill phase or an earlier previously undefined transitional late Middle Archaic complex. Because of the relative lack of data in general on either lowland Archaic or Middle Archaic sites for the Kansas City area, the site was considered to be significant. Since the site was part of the Blue Springs Lake Archaeological District, it was National Register eligible.

While the impact of the sewerline had been mitigated, adverse impact due to erosional action when the Blue Springs Lake reached flood pool level was anticipated. It therefore was recommended that

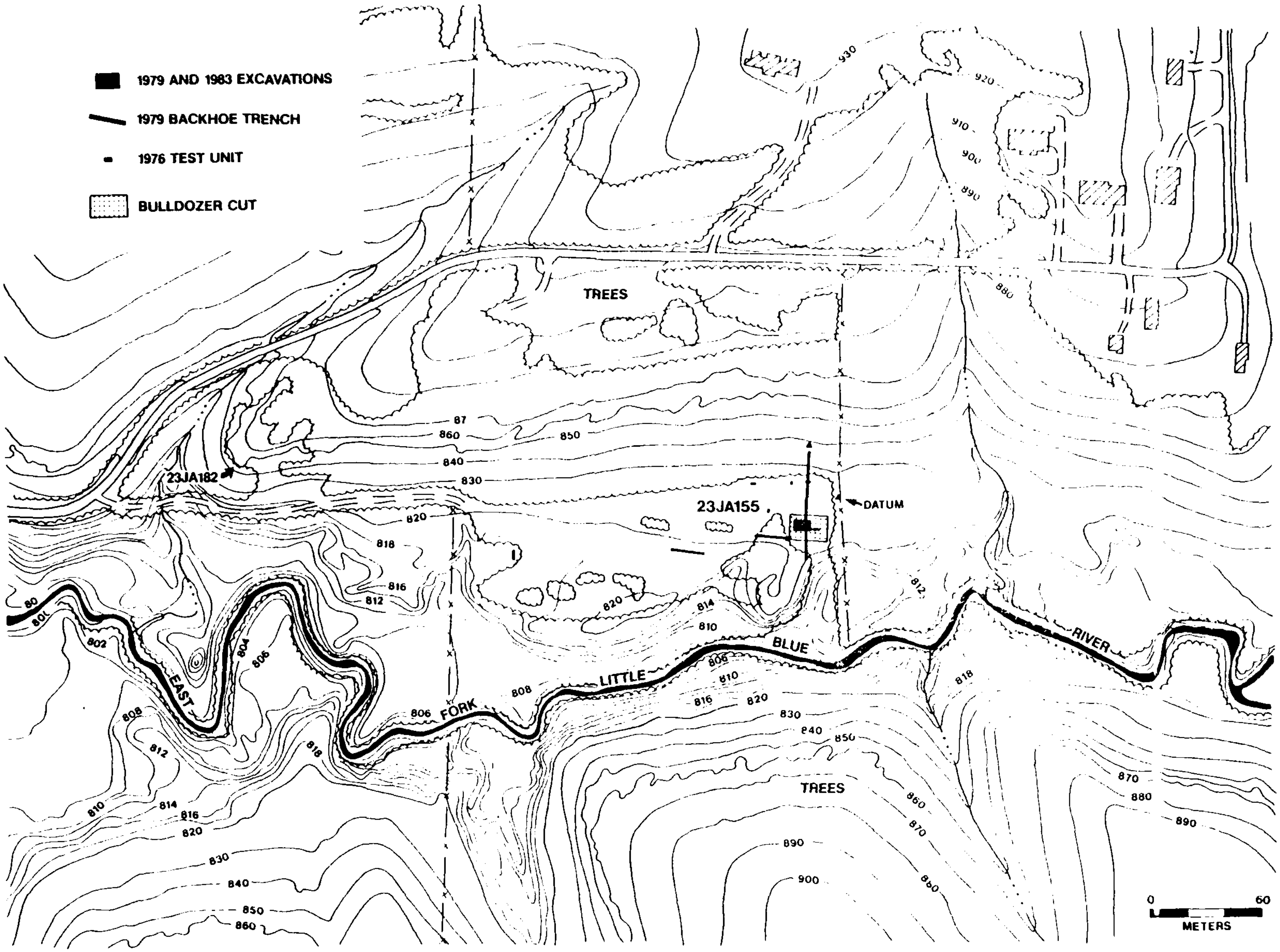


Figure 18. Location and plan view of the 1979-1983 excavations at 23JA155.

appropriate action be taken to preserve the site or that extensive data recovery investigations be initiated to recover an adequate sample of archaeological data from the site (Schmits and Reust 1982a).

DESCRIPTION OF THE EXCAVATIONS

The initial 1979 test excavations conducted by Soil Systems, Inc. consisted of a series of shovel cuts and test units dispersed over the T-1 terrace. No cultural material was recovered from these units. A reexamination of the collection recovered from the 1976 test excavations indicates that most of the material collected by the University of Kansas was natural chert debris and was probably redeposited from the bluff slope by colluvial action. The Woodland component located in 1976 appears to represent either an isolated find spot or a very thin special use area with limited archaeological visibility.

Part of the 1979 SSI mitigation program at Blue Springs Lake consisted of a backhoe trenching program designed to investigate the alluvial sequence of the Little Blue valley (Kopsick 1982). Consequently, the site was of considerable interest due to the presence of the older terrace fill. In order to investigate the older terrace deposit more thoroughly, a backhoe trench, later designated as the North Trench, was cut from the bluff face across the terrace at 23JA155 (Figure 18). The stratigraphy revealed by this trench consisted of an upper deposit, designated as Unit B, overlying a lower depositional unit (Unit A) capped by a buried paleosol. As the trenching operations progressed southward, evidence of a buried cultural level was encountered in Unit A at a depth of approximately 2 m below the surface. No evidence of the upper component located by Brown in 1976 was encountered in the backhoe trench.

The testing of the buried component at 23JA155 initially consisted of expansion the west side of the backhoe trench (North Trench) so as to permit the excavation of a two by three meter test block. However, due to the deeply buried location of this component, only limited testing was possible during the summer of 1979. These limited investigations resulted in the recovery of bifacial and unifacial tools and a large quantity of lithic flaking debris. They also indicated that the cultural material was distributed in a thick zone approximately 80-90 cm in thickness extending from a depth of 180 to 270 cm below the surface although the most concentrated deposits occurred in a narrower zone approximately 50 cm in thickness. The position of the cultural deposit in an older terrace fill and the absence of ceramics indicated that the site was of considerable antiquity and potential significance.

The additional test excavations funded by the Environmental Protection Agency were undertaken in December of 1979 (Schmits and Reust 1980). This work expanded the initial test block to the east of the backhoe trench and resulted in the recovery of several projectile points and charcoal samples for radiocarbon dating. A backhoe was used to remove the sterile overburden down to the top of the concentrated zone

of cultural deposits at a datum depth of 6.9 m. Hand excavations continued to a datum depth of 8.2 m or to the base of the cultural zone.

Five additional backhoe trenches were also cut to determine the limits of the site relative to the Sewerline Interceptor right-of-way. The first of these, the South Trench, was 18 m long and consisted of an extension of the North Trench to determine the southern limits of the site (Figure 18). This trench was taken to a depth ranging from 3.8-5.0 m below the surface and revealed that the stratigraphic sequence observed in the North Trench continued to the south. Within the trench, a bed of patinated chert terminated a few m south of the test excavations (Figure 18). Inspection of the walls of the trench also revealed that the buried cultural stratum extended 10-12 m to the south and then pinched out. The paleosol at the top of Unit A also decreased in thickness in this direction.

Three backhoe trenches were cut to the west along the centerline of the Interceptor right-of-way to delineate the western limits of the site (Figure 18). These trenches, referred to as West I, West II and West III, were cut to a depth ranging from 4.3 to 4.8 m below the surface. This depth was sufficient to intersect the buried cultural deposit. Backhoe Trench West I was 20 m long and was cut to a maximum depth of 4.3 m. Cultural material was recovered from the eastern half of the trench. Artifacts recovered included a core, a number of flakes, and chips and charcoal flecks at a depth of 3.8-4.2 m below the surface. The artifacts in Trench West I were concentrated in the eastern section of the trench and the cultural stratum appeared to pinch out entirely three-quarters of the way across the trench. Backhoe Trenches West II and III indicated the same general stratigraphic sequence observable in the North, South and West I trenches. However, no evidence of cultural remains was encountered. The paleosol which was so well marked in these other trenches pinched out between West II and West III. A fifth backhoe trench (East Trench) was cut from the north-south backhoe trench eastward revealing that the burial cultural deposit extended to the east beyond the limits of the test excavations.

The 1983 field investigations at 23JA155 initially reestablished the site grid employed during the 1979 test excavations. A front end loader was used to open a 20 by 14 m trench over the 1979 test block to a depth of 1.8 m below surface, removing the culturally sterile overburden (Figure 19). A smaller skid-steer loader was then used to remove the final 10 cm of culturally sterile overburden to ensure minimal damage to the buried cultural deposit during overburden removal. Upon completion of the trench, the backfill was removed from the 1979 test block. Two metal stakes placed within the 1979 test block were relocated and the horizontal grid and vertical datum were reestablished.

The 1983 excavations at 23JA155 consisted of expansion of the test block to the east, west and north. A total of 17 additional one by one meter units were hand excavated to a depth of 90 cm below the bulldozer cut. At the termination of field work, the block had been expanded to a 5 by 9 m area (Figure 18). Throughout the 1979 and 1983 excavations, each one by one m excavation unit was hand excavated in arbitrary 10 cm levels beginning at a datum depth of 6.9 m. Excavation methods

Figure 19. General views of the excavations at 23JA155. General view of overburden removal (upper) and the excavation in progress (lower).

consisted of shovel scraping and trowling. All artifacts recovered from the block excavation were collected by one meter excavation units and by arbitrary 10 cm excavation levels. Formal tools, cores and larger pieces of unworked stone were individually mapped. Flotation samples were taken from two levels near the center of the cultural deposit within each excavation unit.

The flotation samples from the 1979 test excavations have been sorted and analyzed (Table 28). A total of 2481 pieces of micro-debitage, 53 minerals, 127 pieces of unworked bone, 4 seeds and 8 carbonized nut shells were recovered. Further flotation samples collected in 1983 have not been analyzed.

Table 28. Micro-debris recovered from flotation samples at 23JA155.

PROVENIENCE	DATUM DEPTH (m)	VOLUME (Liters)	DEBITAGE	MINERALS	UNWORKED BONE	CARBONIZED SEEDS	NUTSHELLS
E499, N499	7.50-7.60	26.0	183	10	5		
E500, N498	7.70-7.80	7.5	152	2	23		
E500, N499	7.45-7.62	4.0	39	1	1		
E500, N499	7.45-7.62	4.0	48	3	3		
E501, N499	6.88-6.98	11.0	22				
E501, N499	7.08-7.18	13.0	692		19	1	
E501, N499	7.60-7.70	5.0	56		3		
E501, N499	7.80-7.90	11.5	113	5	11		
E501, N499	8.00-8.10	6.5	35	7			
E501, N500	7.60-7.70	6.0	101		6		
E501, N501	6.94-7.04	7.0	37			1	
E501, N501	7.14-7.24	8.0	76		4	1	
E501, N501	7.24-7.34	5.0	98	3	9		
E501, N501	7.34-7.44	8.0	82	12	2		
E501, N501	7.70-7.80	5.5	44		5		
E501, N501	7.80-7.90	7.0	51	1			
E503, N499	7.50-7.60	8.5	59		9	1	
E503, N499	7.80-7.90	8.0	169		16		8
E503, N500	7.50-7.60	8.0	175		11		
E503, N501	7.60-7.70	8.0	249	9			
TOTAL		167.5	2481	53	127	4	8

STRATIGRAPHY

The stratigraphy of the terrace fill at the Cold Clay site consists of two depositional units referred to as Units A and B (Figure 20). The upper deposit, Unit B, consists of a clayey silt extending from the surface to a depth of approximately 70 cm. This deposit is characterized by a moderately developed soil and is probably alluvium and colluvium from the adjacent hillside. The lower deposit (Unit A) extends from a depth of 70 cm below the surface to at least 4.0 m below the surface (the base of the test excavation and backhoe trench). The Unit A sediments consist of gray brown (10YR4/2) and very dark gray (10YR3/1) clayey silts. Physical and chemical data for the soils developed in Units A and B are given in Table 29.

The upper 60 cm of Unit A contain a buried paleosol indicative of a period of landscape stability (Table 29). Unit A also contains a bed of patinated limestone and chert pebbles located at a depth of 150 cm below the surface. This bed of coarse material probably resulted from a period of intensive erosion and gully washing on the hillside. The buried cultural deposit occurs just below the patinated chert bed at a depth of 1.8 to 2.7 m.

The cultural zone consists of a zone of lithic debris, broken tools, small fragments of charcoal and burnt bone located in the 2Cb soil horizon. The cultural zone slopes to the south and is about 30 cm deeper on the southern end of the excavation. This slope is slightly steeper than the present ground surface. The cultural zone was fairly level along an east-west axis. While the deposit is as much as 80-90 cm thick, the highest concentration of material, including the majority of the tools, occurs in a 50 cm thick layer near the center of the cultural zone. The large vertical distribution of materials appears to be primarily due to crayfish bioturbation. Numerous vertically oriented tubular stains extending from the upper paleosol were visible in the profile. No features, such as hearths or pits or discrete activity areas, were defined during the excavation, although the charcoal and burnt bone would indicate that cooking features were present at the site.

The surface soil at 23JA155 is described by the Jackson County Soil Survey (Preston 1984) as belonging to the Bremer Series, a member of the fine, Montmorillonitic, mesic family of Typic Argriaguolls. Bremer soils typically have black friable silty clay loam A horizons, very dark gray, dark gray and dark grayish-brown, heavy, silty clay loam Bt2 horizons that are distinctly mottled, and gray, firm, silty clay loam C horizons.

The soil profile at 23JA155 is very similar to that described for the Bremer Series except for the abruptness of the horizon boundaries at a depth of approximately 70 cm below the surface. A dark gray (10YR4/1) silty clay loam at the base of Unit B abruptly gives way to a very dark gray (10YR3/1) silty clay loam at the top of Unit A. Based on color alone, the soil in the upper 20 cm of Unit A appears to be a buried A horizon. However, this soil has clay films and medium subangular blocky structure which indicate that it is part of an argillic B horizon.

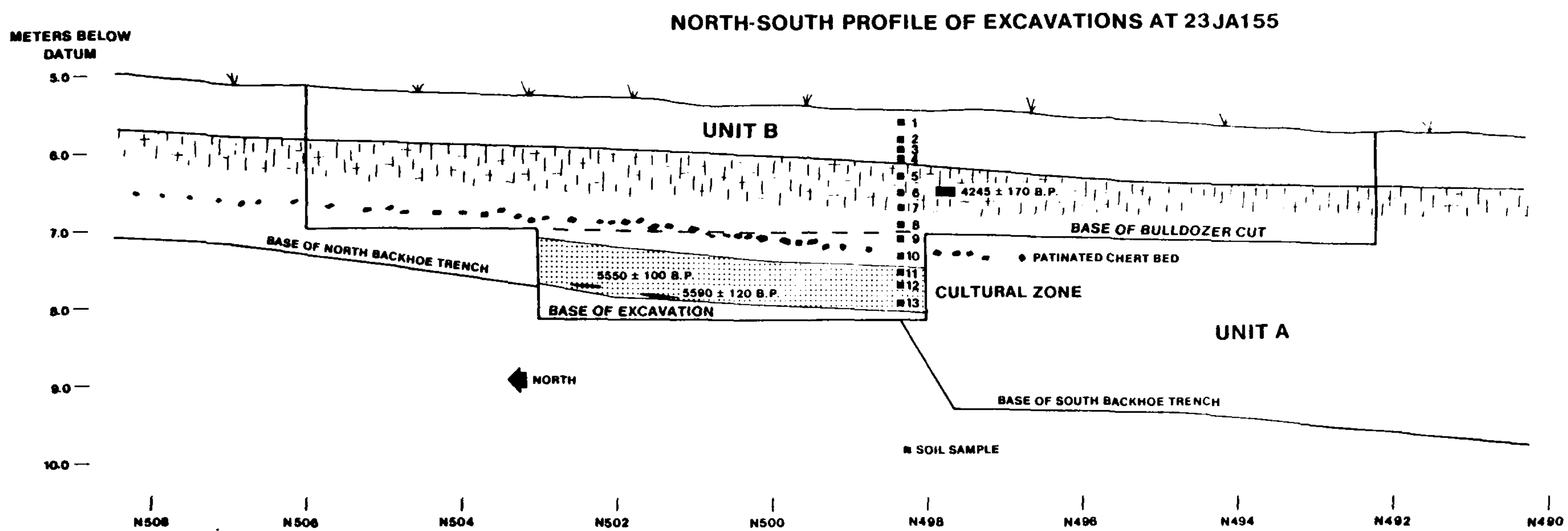


Figure 20. Profile of the excavation and backhoe trenches at 23JA155.

Table 29. Physical and chemical properties of soils at 23JA155.

SAMPLE NUMBER	UNIT	SOIL HORIZON	DEPTH (cm)	PARTICLE SIZE DISTRIBUTION Sand (%)	Silt (%)	Clay (%)	pH	ORGANIC CARBON (%)
1	B	Ap	10-14	15	61	24	6.6	2.6
2	B	A13	35-39	16	57	27	6.8	1.4
3	B	Bw1	50-54	17	54	29	6.6	1.2
4	B	Bw2	60-64	17	52	31	6.7	1.2
5	A	2Bt1b	80-84	15	49	36	6.3	1.0
6	A	2Bt21b	100-104	17	47	36	6.2	0.9
7	A	2Bt22b	120-124	15	49	36	6.3	0.8
8	A	2Bt3b	140-144	23	45	32	6.3	0.9
9	A	2Cb	160-164	23	45	22	6.4	0.6
10	A	2Cb	180-184	19	47	34	6.6	0.4
11	A	2Cb	200-204	17	50	33	6.6	0.6
12	A	2Cb	220-224	17	49	35	6.5	0.5
13	A	2Cb	240-244	19	46	35	6.6	0.5

Thus, the paleosol at the top of Unit A was truncated down to its B horizon prior to burial by sediments of Unit B.

The fine grain size of the sediments suggests that deposition of Unit A occurred in an overbank floodplain environment. At the time of the Archaic occupation, the site probably consisted of a moist, open depressional area of the floodplain which was seasonally inundated by flooding. The soil mottling in Unit A indicates impeded drainage. There is also evidence of extensive crayfish bioturbation.

Radiocarbon dates of 5550±100 years B.P. and 5590±100 years B.P. were determined on charcoal recovered at depths of 2.60 m and 2.78 m, respectively. The charcoal was from the cultural level beneath the lower chert bed in Unit A (Figure 20). In addition, a radiocarbon date of 4245±170 years B.P. was determined on humic acids from the 2Bt22b

horizon of the buried paleosol in Unit A. Based on the stratigraphic record and radiocarbon dates from Cold Clay, deposition of Unit A was initiated at some time prior to ca. 5600 years B.P. The lack of soil development in the lower 2.0 m of Unit A suggests that this interval of deposition was rapid. There was an episode of hillside erosion soon after ca. 5550 years B.P. that resulted in the deposition of the patinated chert bed in Unit A. Deposition of T-1 sediments slowed during the late Holocene and the surface of Unit A became stable at approximately 4000 years B.P.

The period of stability following the deposition of Unit A was terminated by the erosional event which truncated the paleosol. Based on the contracting stemmed point recovered by Brown (1977) from Unit B, renewed deposition probably occurred during the very late Late Archaic or early Early Woodland periods (ca. 1000-3000 years B.P.). The composition of the Unit B sediments indicate that they were partially derived from the adjacent hillside through colluvial action.

Table 30. Soil profile description at 23JA155.

DEPOSITIONAL UNIT	SOIL HORIZON	DEPTH (cm)	Description
B	Ap	0-20	Brown (10YR4/3) to dark brown (10YR3/3) silt loam; weak fine granular structure; friable; many very fine roots, neutral; abrupt smooth boundary.
B	A13	20-45	Brown (10YR4/3) to dark brown (10YR3/3) silty clay loam; weak medium granular structure; friable; common very fine roots; neutral; clear smooth boundary.
B	Bw1	45-55	Brown (10YR4/3) to dark brown (10YR3/3) silty clay loam; weak fine subangular blocky structure; friable; few very fine roots; neutral; clear smooth boundary.
B	Bw2	55-70	Dark gray (10YR4/1) silty clay loam; moderate fine subangular blocky structure; firm; common open pores; few very fine roots; neutral; abrupt smooth boundary.

continued

Table 30 continued. Soil profile description at 23JA155.

DEPOSITIONAL UNIT	SOIL HORIZON	DEPTH (cm)	Description
A	2Bt1b	70-90	Very dark gray (10YR3/1) silty clay loam; moderate medium subangular blocky structure; common clay films on faces of peds; common fine pores; slightly acid; clear smooth boundary.
A	2Bt22b	90-130	Very dark gray (10YR3/1) silty clay loam; weak medium prismatic parting to medium angular blocky structure; common clay films on faces of peds; common fine pores; slightly acid; clear smooth boundary.
A	2Bt3b	130-155	Very dark gray (10YR3/1) clay loam; common medium gray brown (10YR4/2) mottles; weak coarse angular blocky; prominent clay films on faces of peds; few open pores; common angular chert fragments in lower 5 cm; slightly acid; clear smooth boundary.
A	2Cb	155-240	Very dark gray (10YR3/1) silty clay loam; common medium angular blocky structure grading to massive below; Mg and Fe stains increase with depth; common crayfish crotovinas; cultural deposit in lower 60 cm; neutral.

RADIOCARBON DATES

Five radiocarbon dates are available from 23JA155 (Table 31). Four dates (DIC-1678, DIC-1679, Beta-8536 and Beta-12,000) are based on charcoal recovered from the cultural level in Unit A. These were all from the 2Cb soil horizon. The fifth date (Beta-1325) is based on organic humic acids recovered from a bulk sediment sample taken from the 2Bt22b paleosol near the top of Unit A.

Initially during the 1979 testing program, samples of charcoal from the cultural level were submitted to Dicarb Radioisotope Co. These samples dissolved in a 2N NaOH base used for humic acid pretreatment. Since the two remaining charcoal samples (DIC-1678 and DIC-1679) were small, further humic acid pretreatment of these samples was deleted from the procedure. Small amounts of the samples were treated with the base to check for humic acid discoloration and almost no humic acid discoloration appeared. Irene Stehle of Dicarb Radiosotope Co. (personal communication) noted that the actual radiocarbon age of the samples could actually have been older since they were not pretreated for humic acid contamination.

Table 31. Radiocarbon dates from 23JA155.

SAMPLE NUMBER	LAB NO.	SOIL HORIZON	PROVENIENCE	DATUM DEPTH (m)	DATE B.P.	DATE B.C.
1*	DIC-1678	2C1	South Trench	8.22	4540±150	2590
2*	DIC-1679	2C1	E503, N501	7.40-7.50	4180±95	2230
3	Beta-1325	2Bt22b		6.26-6.33	4245±170	2295
4	Beta-8536	2C1	E499, N501	7.78-7.82	5590±120	3640
5	Beta-12,000	2C1	E497, N502	7.60-7.70	5550±100	3600

*Samples were not pretreated for humic acid

As a result of the 1983 excavations two additional charcoal samples were obtained. These samples consisted of better preserved carbonized wood and were sent to Beta Analytic, Inc. for radiocarbon dating. The dates returned were a consistent 5590±120 and 5550±100 years B.P. These two dates are stratigraphically consistent with the upper Beta date of 4245±170 years B.P. from the 2Bt22b horizon, and they are considered to be the best estimate of the radiocarbon age of the buried cultural occupation at 23JA155.

LITHIC ASSEMBLAGE

The lithic assemblage recovered from the buried component at 23JA155 includes 9280 chipped stone tools, pieces of lithic manufacturing debris, ground stone tools, minerals and unworked stone. The distribution of this material by excavation level is shown in Table 32.

Chipped Stone Tools

Bifacial chipped stone tools include a total of 12 points, two knives, one scraper, 50 blanks and preforms and 45 fragments. Uni-

Table 32. Artifact assemblage from 23JA155.

	METERS BELOW DATUM 6.6–6.7	6.7–6.8	6.8–6.9	6.9–7.0	7.0–7.1	7.1–7.2	7.2–7.3	7.3–7.4	7.4 7.5	7.5–7.6	7.6–7.7	7.7–7.8	7.8–7.9	7.9–8.0	8.0–8.1	BACKHOE TRENCHES	TOTAL
CHIPPED STONE TOOLS																	
Projectile Points								1		3	4	2	1	1			12
Bifacial Knives											1	1					2
Bifacial Blanks					1	3	4	2	2	4	9	4	3	3		1	36
Bifacial Preforms						2		1	1	3	5	1	1				14
Bifacial Scraper								1									1
Biface Fragments						2	8	3	9	7	10	3	3				45
Unifacial Scrapers									1			1					2
Flake Scrapers					1				1								2
Edge-Modified Cores									2	2		3					7
Edge-Modified Flakes		1		8	11	33	35	54	60	73	44	40	10	4		2	375
Edge-Modified Chunks					2	2	1	4	4	5	7	10					35
Total		1		8	15	42	48	66	80	97	80	65	18	8		3	531
GROUND STONE TOOLS																	
Metate										1							1
Mano-Nutting Stone													1				1
Abrader						1											1
Fragments						1					1						2
Total						2				1	1		1				5

continued

Table 32 continued. Artifact assemblage from 23JA155.

	6.6–6.7	6.7–6.8	6.8–6.9	6.9–7.0	7.0–7.1	7.1–7.2	7.2–7.3	7.3–7.4	7.4–7.5	7.5–7.6	7.6–7.7	7.7–7.8	7.8–7.9	7.9–8.0	8.0–8.1	BACKHOE TRENCHES	TOTAL
	METERS BELOW DATUM																
LITHIC MANUFACTURING DEBRIS																	
Flakes	2	3	7	61	135	299	314	364	444	456	347	191	121	12	4	66	2826
Chunks		2	3	6	14	28	31	60	78	84	59	42	11	5		11	434
Shatter			6	37	90	167	134	208	264	247	189	104	25				1471
Chips	5	9	5	78	209	552	325	509	476	515	513	258	85	9	4	32	3584
Cores					2	4	3	10	13	22	15	8	4	1	1	1	84
Total	7	14	21	182	450	1050	807	1151	1275	1324	1123	603	246	27	9	110	8399
MINERALS																	
Limonite							1		1	1	4	4					11
Ocher					1			1	2	2	2	2	1				11
Soft Hematite				3	1	8	22	22	21	23	14	10	2	1			127
Hard Hematite							1	1	1								3
Total				3	2	8	24	24	25	26	20	16	3	1			152
UNWORKED STONE	2	4	16	3	19	26	10	9	35	13	8	21	8		3	4	181
BURNT SEDIMENT						2	3	1	2	1	2	1					12
Total	2	4	16	3	19	28	13	10	37	14	10	22	8		3	4	193
TOTAL	9	19	37	196	486	1130	892	1251	1417	1462	1234	706	276	36	12	117	9280

facial, marginally retouched and edge-modified tools include two unifacial scrapers, two flake scrapers, seven edge-modified cores, 375 edge-modified flakes and 35 edge-modified chunks. Edge-modified tools were sorted from the debitage macroscopically. Microscopic examination of the debitage sample would undoubtedly increase the number of informal tools.

The chipped stone tools are made almost entirely of blue gray Winterset chert available from the Winterset limestone outcrop on the slope just north of the site. However, several non-local cherts which are not available either in the immediate vicinity of the site or within the Kansas City area are also present in the assemblage.

The artifact collection recovered from the 1979 SSI excavations which were curated at the University of Kansas Museum of Anthropology were obtained and included within the present analysis. One preform and 22 cores from the 1979 excavations could not be relocated and apparently have either been lost or misplaced at the University.

Projectile Points (n=12)

A total of 12 projectile points were recovered including the three from the 1979 test excavations. Included are four corner-notched, two straight stemmed, four expanding stemmed, one side-notched and one lanceolate specimen (Table 33). The four corner-notched points include one complete and three fractured specimens made from large subtriangular preforms with lenticular cross-sections and slightly convex bases (Figure 21a-d). The complete specimen is much smaller than the three fragments. Two of the larger corner-notched points have transverse blade fractures. The third has a compound transverse and diagonal fracture. Three corner-notched points are made from unheated non-local light gray cherts. The fourth is heated Winterset chert. One has blunting and smoothing along one lateral margin indicating general cutting use.

The side-notched point is an asymmetric point made from a narrow triangular preform with a thin lenticular cross-section and a straight base (Figure 21e). It is made from unheated Winterset chert and has smoothing and polishing on the edge indicating general cutting use. The two straight stemmed points are made from narrow medium-sized subtriangular preforms with straight bases and a slightly biconvex cross-section (Figure 21f-g). Both are Winteret chert and one appears to have been heated. One has an impact fracture.

The four expanding stemmed points are made from large to medium-sized triangular to subtriangular preforms with straight bases. Only one specimen has a concave base (Figure 21k). In cross-section these points are lenticular to slightly biconvex. Two expanding stemmed points have severe impact fractures (Figure 21h-i) and two have transverse blade fractures (Figure 21j-k). All four are made from Winterset chert and only two appear to have been heated. One has blunting along a lateral margin indicating heavy-duty cutting use. Another has blunting and smoothing indicating general cutting use.

The lanceolate point has a straight base and fairly thick slightly

Table 33. Descriptive data for projectile points from 23JA155.

CATALOG NUMBER	PROVENIENCE	DATUM DEPTH (m)	POINT TYPE	CHERT TYPE*	** WEAR	WT. (g)	LGTH	WDTH	STEM WDTH	DIMENSIONS (mm) BASE WDTH	STEM LGTH	NOTCH WDTH	NOTCH DEPTH	THICK -NESS
644	E503,N499	7.86	Corner-notched	NL		7.0	39	30	20	24	11	8	5	8
664	W503,N500	7.56	Straight stemmed	WN+		9.5	-	25	21	20	18	18	2	10
755	E504,N498	7.92	Lanceolate	NL+	IF	10.2	43	25	NA	24	NA	NA	NA	10
971	E497,N499	7.70	Corner-notched	NL		13.8		50	29	37	14	10	11	9
1047	E497,N500	7.66	Side-notched	WN	GC	4.9	48	18	12	20	9	7	3	7
1517	E499,N500	7.65	Expanding stemmed	WN		9.8	-	-	29	30	17	19	-	9
1552	E499,N50	7.40	Corner-notched	NL	GC	8.1	-	-	23	28	15	9	-	10
1680	E500,N500	7.74	Straight stemmed	WN		10.6	46	26	21	20	14	11	3	10
2138	E505,N499	7.58	Expanding stemmed	WN+	GC	8.4	-	34	22	27	13	12	6	9
2293	E499,N499	7.79	Expanding stemmed	WN+	IF	15.7	-	33	22	26	14	11	6	11
2294	E500,N499	7.69	Corner-notched	WN+	GC	10.6	-	-	23	30	9	9	-	10
2295	E504,N499	7.60	Expanding stemmed	WN	HDC, IF	11.2	-	32	23	25	11	9	5	9

*WN=Winterset; NL=Non-local; +=Thermal alteration
**GC=General Cutting, HDC=Heavy-Duty Cutting, IF=Impact Fracture

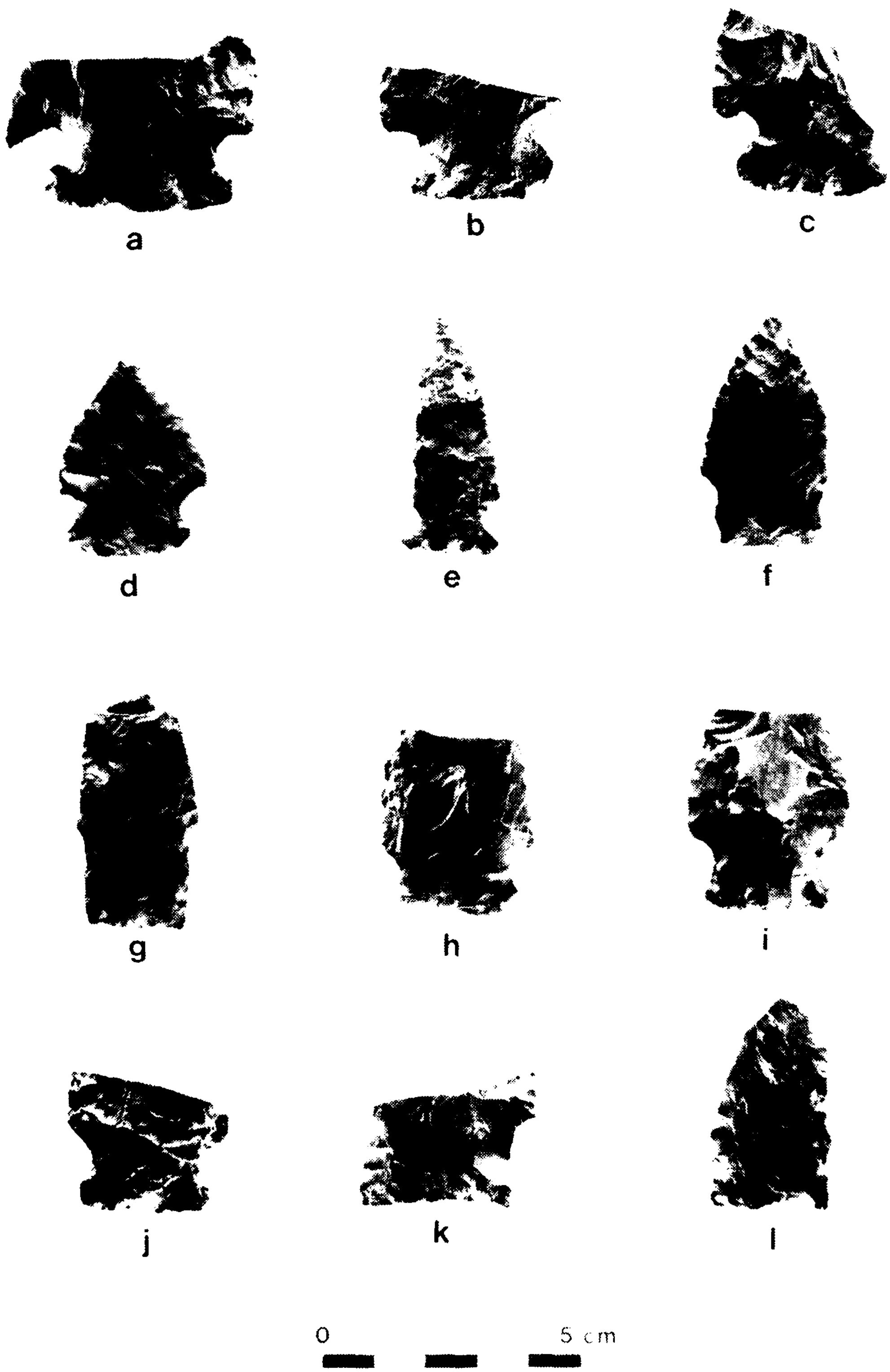


Figure 21. Projectile points from 23JA155; a-d, corner-notched; e, side-notched; f-g, straight stemmed; h-k, expanding stemmed; l, lanceolate.

biconvex cross-section (Figure 211). It is made from a heated non-local chert and has a large diagonal impact fracture.

Bifacial Preforms (n=14)

A total of 14 bifacial preforms were recovered. This total includes one specimen (Catalog Number 431) from the 1979 excavations which apparently has been lost or misplaced. Four of the preforms cross-mend reducing the total number of specimens to 12. In general, the preforms appear suitable for modification into projectile points by minimal thinning and preparation of the haft element by notching.

Ten of the preforms are subtriangular bifaces with straight to slightly convex bases and lenticular cross-sections. Three are complete, four have transverse fractures, one has a diagonal fracture and one has two longitudinal thermal fractures. All are Winterset chert and only the latter specimen appears to have been heated. Three specimens including the missing specimen (illustrated here from a photograph taken in 1980) appear to have slight modifications of their proximal lateral margins for hafting (Figure 22a-c). The majority of the preforms appear suitable for manufacture into expanding stemmed points (Figure 22a-f). The remaining subtriangular preform appears to be suitable for manufacture into a large corner-notched point (Figure 22 j). This preform has a diagonal fracture and was made from a thin tabular Winterset blank which has been heated. This preform also has a diagonal fracture and unifacial planoclinal retouch along the base forming an edge suitable for scraping.

The two remaining preforms are mainly distinguished by their narrow width and biconvex cross-section. One made from unheated Winterset chert has a transverse fracture (Figure 22k). The second, made from heated Winterset chert, has a longitudinal thermal fracture (Figure 221). Preliminary haft modification is present on the latter and consists of a shallow notch on the lateral margin opposite the thermal fracture. Only two preforms exhibit use-wear. One has grinding and blunting indicating heavy-duty cutting use. The second has blunting at the tip indicating use for graving or incising.

Bifacial Blanks (n=36)

A large number of bifacial blanks were recovered. All are made from Winterset chert and only four appear to have been heated. One heated specimen is tan Winterset chert. Twenty-three blanks are fragmentary and 13 are complete. The broken blanks all have transverse or diagonal fractures and appear to have broken while being thinned. The majority of the blanks appear to have been made from tabular or blocky Winterset cores. All have been bifacially edged and are characterized by at least primary flaking. The blanks vary from 10 to 39 mm in thickness. The thick blanks appear to have been either broken or discarded early in the reduction process and generally are characterized by only primary thinning (Figure 23a-c). Many have impurities, ridges or bumps that were not successfully removed. Other thinner blanks exhibit secondary thinning (Figure 23d-i) and are often fractured during lateral thinning. The heated blanks are all thin and exhibit secondary thinning scars suggesting that heat treatment occurred after secondary thinning. Fifteen blanks exhibit use-wear including

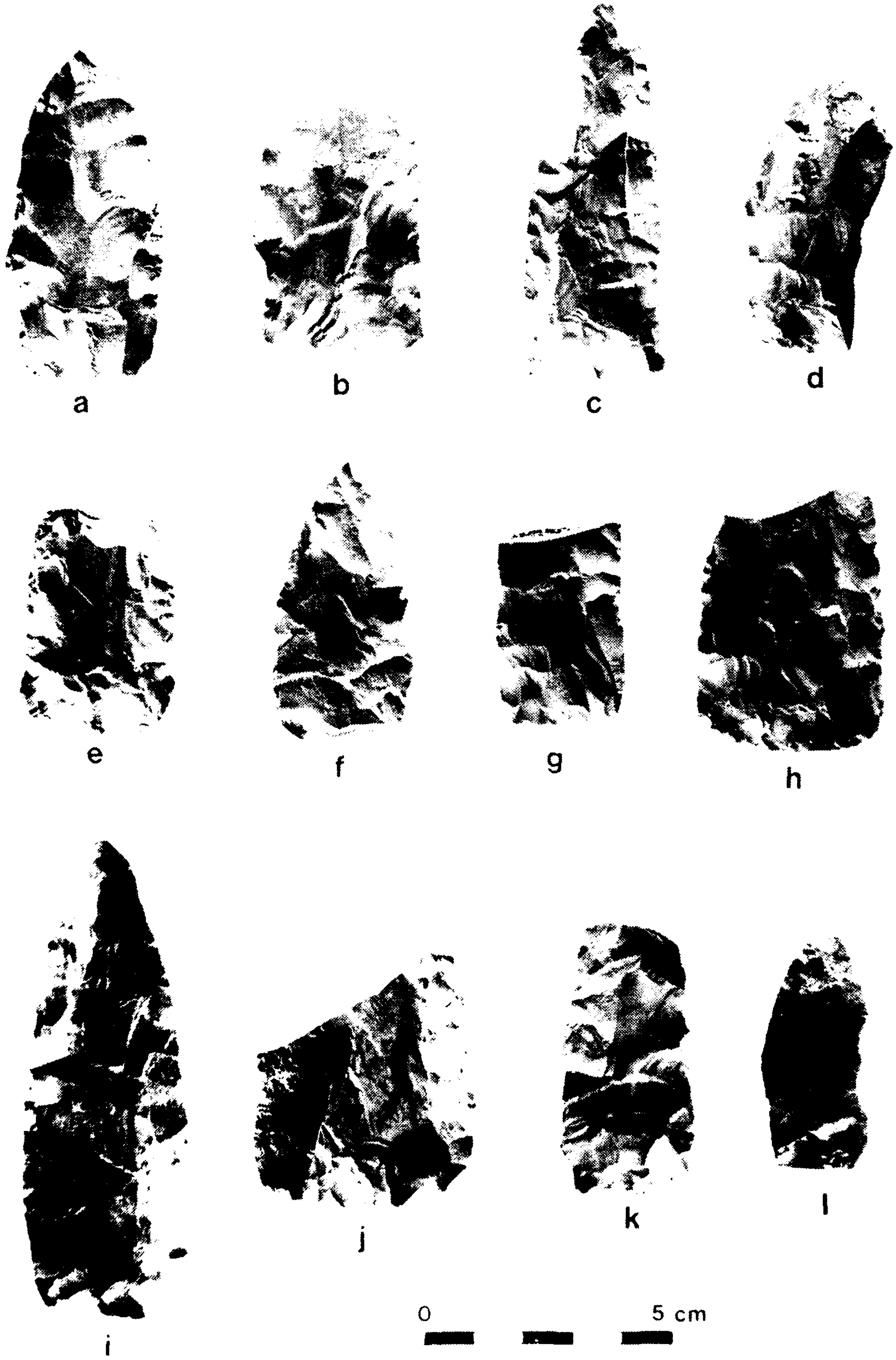


Figure 22. Bifacial preforms from 23JA155.

Figure 23. Bifacial blanks from 23JA155: a-c, blanks with primary thinning; d-i, blanks with secondary thinning.

Table 34. Descriptive data for bifacial tools from 23JA155.

CATALOG NUMBER	TOOL TYPE	PROVENIENCE	DATUM DEPTH (m)	CHERT TYPE**	USE WEAR ***	WEIGHT (g)	DIMENSIONS (mm) LGTH	WDTH	THICK -NESS
306	Knife	E501, N501	7.79	WN	GC	28.3	66	41	9
1668	Knife	E500, N500	7.62	NLW	GC	12.8	-	36	8
1455	Scraper	E498, N502	7.39	WN	GS	80.4	68	54	22
195	Preform	Backhoe Tr.7	7.84	WN+	GI	17.0	56	-	10
431****	Preform	E499, N498	7.62	WN		20.2	67	32	10
753	Preform	E500, N499	7.61	WN	HDC	23.4	-	-	14
*916	Preform	E497, N498	7.33	WN		23.0	79	30	10
*1333	Preform	E498, N500	7.59						
*974	Preform	E497, N499	7.65	WN		23.0	-	35	12
*1661	Preform	E500, N500	7.55						
1356	Preform	E498, N500	7.68	WN		27.5	-	37	14
1413	Preform	E498, N501	7.60	WN		14.3	57	28	11
1446	Preform	E498, N502	7.15	WN+	IF	12.8	50	22	11
1447	Preform	E498, N502	7.20	WN+		24.1	-	47	8
1669	Preform	E500, N500	7.61	WN		17.2	-	32	8
1681	Preform	E500, N500	7.73	WN		13.9	-	28	10
2107	Preform	E504, N502	7.48	WN		42.7	100	3	12
96	Blank	E501, N498	7.60–7.70	WN	GS	17.2	-	38	8
337	Blank	E500, N498	7.78	WN		11.2	-	27	13
346	Blank	E500, N498	7.85	WN	HDS	19.7	-	-	11
376	Blank	E501, N499	7.44	WN	GI	27.6	-	-	16
441	Blank	E499, N498	7.82	WN	HDC	36.6	64	38	18
442	Blank	E499, N498	7.80	WN	LDS	29.1	-	-	12
467	Blank	E501, N500	7.75	WN	GC	34.5	-	47	14
526	Blank	E502, N499	7.70	WN		30.0	-	45	17
648	Blank	E503, N500	7.32	WN	GS	49.1	58	52	15
663	Blank	E503, N500	7.52	WN	GC	21.1	68	28	10
736	Blank	South Trench	7.14	WN+		17.6	-	28	12
743	Blank	South Trench	-	WN		34.6	55	47	16
747	Blank	East Trench	7.63	WN	LDS	23.8	54	-	10
752	Blank	E501, N499	7.93	WN		33.6	-	-	12
928	Blank	E497, N498	7.90	WN		90.2	75	48	24
937	Blank	E497, N498	7.92	WN	GC	91.0	68	55	25
973	Blank	E497, N499	7.64	WN		121.4	77	57	29
1049	Blank	E457, N500	7.65	WN	HDS		-	45	10
1079	Blank	E497, N501	7.19	WN		15.2	-	33	11
1109	Blank	E497, N501	7.51	WN		29.9	60	33	15
1217	Blank	E498, N498	7.22	WN+	GC	14.9	-	46	10
1286	Blank	E498, N499	7.74	WN		77.5	76	55	22
1314	Blank	E498, N500	7.30	WN		36.7		44	16
1426	Blank	E498, N501	7.61	WN		138.3	95	63	25
1518	Blank	E499, N500	7.70	WN		55.8	74	47	20
1546	Blank	E499, N501	7.28	WN		22.2	-	39	14
1567	Blank	E499, N501	7.64	TWN+		19.3	56	39	9
1568	Blank	E499, N501	7.60	WN		71.4	82	-	21

continued

Table 34 continued. Descriptive data for bifacial tools from 23JA155.

CATALOG NUMBER	TOOL TYPE	PROVENIENCE	DATUM DEPTH (m)	CHERT TYPE**	USE WEAR ***	WEIGHT (g)	DIMENSIONS (mm) LGTH	WDTH	THICK -NESS
1587	Blank	E499, N502	7.18	WN		72.2	-	46	19
1670	Blank	E500, N500	7.65	WN+		36.2	-	-	13
1727	Blank	E500, N501	7.6	TWN	LDS	24.9	-	41	10
1792	Blank	E500, N502	7.50	WN		55.0	82	42	18
1927	Blank	E503, N502	7.39	WN	LDS	49.7	-	-	20
2032	Blank	E504, N501	7.27	WN	GS	57.0	-	62	26
2244	Blank	E505, N502	7.08	WN	LDS,GI	40.3	70	43	14
2296	Blank	E498, N502	7.13	WN		35.7	-	42	13
11	Fragment	E499, N498	7.30-7.40	WN	HDC	18.1	-	-	9
*30,	Fragment	E499, N499	7.24	WN+		34.7	-	-	14
*2005	Fragment	E504, N500	7.51						
111	Fragment	E501, N498	7.80-7.90	WN		5.7	-	-	9
215	Fragment	E499, N499	7.67	WN		14.1	-	-	11
249	Fragment	E501, N501	7.25-7.35	WN		7.2	-	-	14
278	Fragment	E501, N501	7.46	WN		1.9	-	-	7
357	Fragment	E501, N499	7.30	WN+		9.2	-	-	9
432	Fragment	E499, N498	7.70	WN		14.5	-	-	11
482	Fragment	E500, N499	7.25	WN	GC	10.1	-	-	7
538	Fragment	E502, N499	7.84	WN	GC	7.8	-	-	9
566	Fragment	E502, N500	7.65	WN	GI				20
625	Fragment	E503, N499	7.50-7.60	WN+		12.1	-	-	10
635	Fragment	E503, N501	7.47	WN		16.6	-	-	12
972	Fragment	E497, N499	7.70	WN		19.5	-	-	11
1001	Fragment	E497, N499	7.85	WN		9.7	-	-	14
1029	Fragment	E497, N500	7.46	WN	GC	10.2	-	-	10
1097	Fragment	E497, N501	7.30-7.40	WN		10.9	-	-	16
1156	Fragment	E497, N502	7.25	WN		9.9	-	-	11
1175	Fragment	E497, N502	7.47	WN+		5.0	-	-	7
1277	Fragment	E498, N499	7.63	WN		5.5	-	-	7
1278	Fragment	E498, N499	7.64	WN		19.3	-	-	14
1287	Fragment	E498, N499	7.75	WN	GC	7.6	-	-	10
1309	Fragment	E498, N500	7.15	NLT		6.6	-	-	9
1319	Fragment	E498, N500	7.35	WN+		5.0	-	-	9
1325	Fragment	E498, N500	7.49	WN		17.7	-	35	11
1334	Fragment	E498, N500	7.60	WN+	HDS	8.1	-	-	10
1355	Fragment	E498, N500	7.62	WN+		12.0	-	-	10
1357	Fragment	E498, N500	7.70	WN		23.3	-	-	13
1404	Fragment	E498, N501	7.45	WN		13.1		30	13
1463	Fragment	E498, N502	7.50	WN+		9.5	-	-	10
1472	Fragment	E498, N502	7.55	WN		7.9	-	-	13
1509	Fragment	E499, N500	7.57	NLT+	GC	21.6	-	-	10

continued

Table 34 continued. Descriptive data for bifacial tools from 23JA155.

CATALOG NUMBER	TOOL TYPE	PROVENIENCE	DATUM DEPTH (m)	CHERT TYPE**	USE WEAR ***	WEIGHT (g)	DIMENSIONS (mm) LGTH	WDTH	THICK -NESS
1528	Fragment	E499, N500	7.75	WN		29.5	-	46	14
1529	Fragment	E499, N500	7.78	WN+		5.4	-	-	11
1620	Fragment	E499, N502	7.55	WN	GS	10.6	-	-	10
1628	Fragment	E499, N502	7.64	WN		8.7	-	37	11
1660	Fragment	E500, N500	7.54	WN+		17.9	-	-	15
1761	Fragment	E500, N502	7.15	WN		18.3	-	-	11
1811	Fragment	E500, N502	7.61	WN		18.9	-	-	16
1919	Fragment	E503, N502	7.25	WN		10.0	-	-	18
1995	Fragment	E504, N500	7.46	WN	HDC	39.9	-	-	27
2033	Fragment	E504, N501	7.24	WN		7.3	-	-	10
2034	Fragment	E504, N501	7.25	WN		25.9	-	-	16
2274	Fragment	E505, N502	7.47	WN+		9.3	-	-	13

*Cross-mended Artifact
**WN=Winterset, TWN=Tan Winterset, NLW=Non-local White, NLT=Non-local Tan, +=Thermal alteration
***GC=General Cutting, LDC=Light-Duty Cutting, HDC=Heavy-Duty Cutting, GS=General Scraping, LDS=Light-Duty Scraping, HDS=Heavy-Duty Scraping, GI=Graving/Incising, IF=Impact Fracture
****Missing Artifact

four with general cutting wear, one with heavy-duty cutting wear, two with general scraping wear, five with light-duty scraping wear, two with heavy-duty scraping wear and two which exhibit graving/incising use.

Bifacial Knives (n=2)

Two bifacial knives were recovered including a smaller ovate specimen and a fragment of an asymmetric knife (Figure 24a-b). The knives are distinguished from preforms primarily by their asymmetrical plan form and by straight biclinal edges which evidence more intensive utilization. The ovate knife is made from unheated Winterset chert (Figure 24a) and has smoothing and blunting along one lateral margin indicating use in general cutting. The triangular knife fragment is made from a heated non-local white chert which is probably Burlington chert (Figure 24b). It has polish, smoothing and heavy-duty flaking wear indicating general cutting use.

Bifacial Scraper (n=1)

The bifacial scraper is a bifacial blank fragment which has been unifacially retouched forming a planoclinal edge on the distal end (Figure 24c). The scraper is made from unheated Winterset chert and has

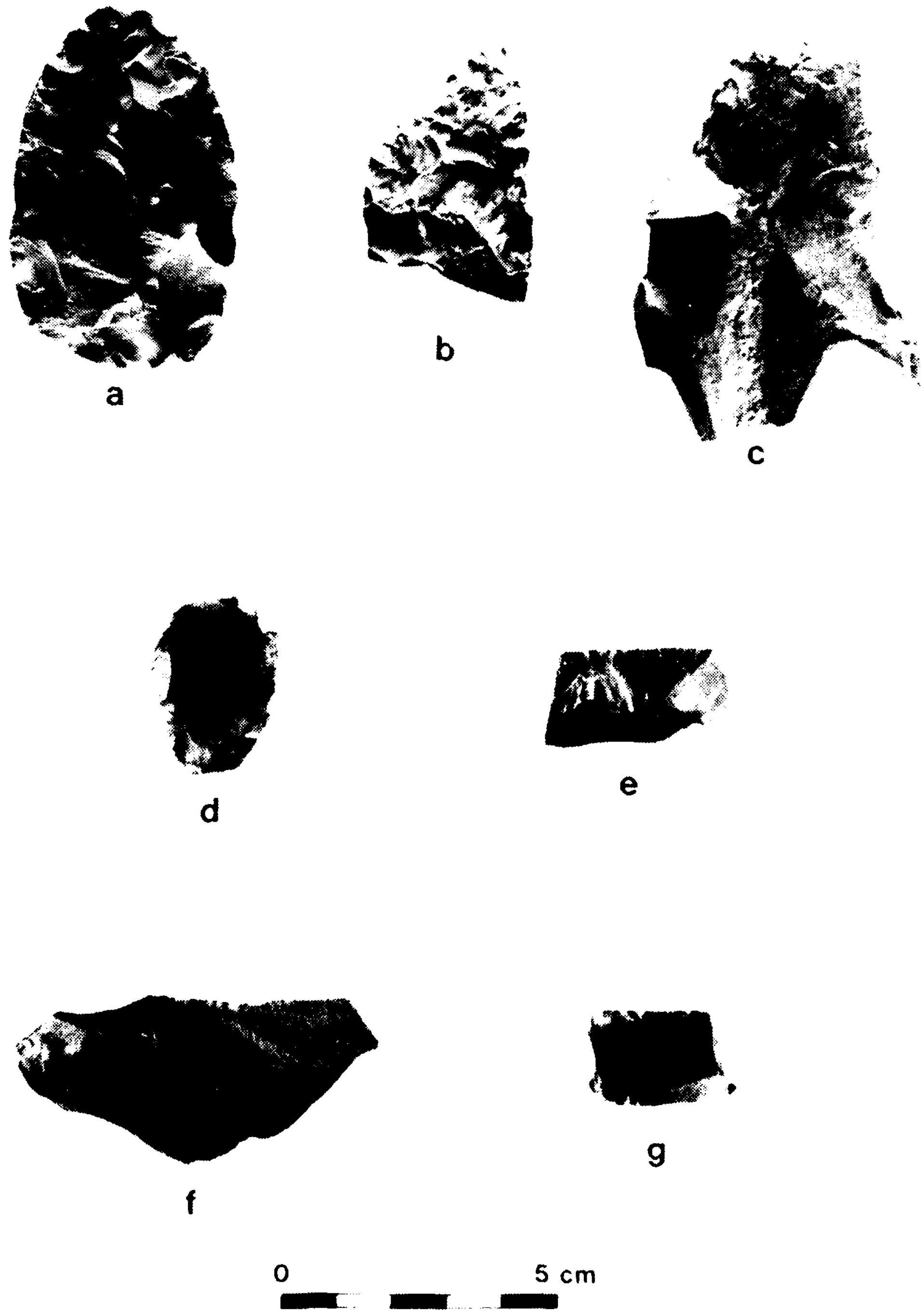


Figure 24. Chipped stone tools from 23JA155; a-b, bifacial knives; c, bifacial scraper; d-e, unifacial scrapers; f-g, flake scrapers.

blunting and smoothing use-wear indicating general scraping use.

Biface Fragments (n=45)

The 45 biface fragments include 22 small fragments. Twelve large thick fragments are probably small sections of bifacial blanks. Ten larger fragments are probably distal tips of points, preforms or thinned blanks. All but two of the biface fragments are made from Winterset chert. The two exceptions are tan non-local cherts. Thirteen biface fragments have been heated. Five biface fragments exhibit general cutting wear, one has heavy-duty cutting wear, one has general scraping wear, one has heavy-duty scraping wear and one has graving/incising wear.

Unifacial Scrapers (n=2)

One unifacial scraper consists of a small unifacially flaked end scraper made from unheated Winterset chert (Figure 24d). It has smoothing and polishing indicating light-duty scraping use. The second is a fragment of a steeply retouched unifacial scraper (Figure 24e). It has polish indicating light-duty scraping use.

Flake Scrapers (n=2)

The two flake scrapers include one with several concave margins of retouch (Figure 24f) and a second fragment of a flake scraper (Figure 24g). The former has smoothing indicating general scraping use, while the latter has very light polish indicating light-duty scraping use.

Table 35. Descriptive data for unifacial and marginally retouched tools at 23JA155.

CATALOG NUMBER	TOOL TYPE	PROVENIENCE	DATUM DEPTH (m)	CHERT TYPE**	*** WEAR	WT. (g)	DIMENSIONS (mm) LGTH	WDTH	THICK-NESS
1609	*Scraper	E499, N502	7.46	WN	LDS	10.4	35	25	13
1146	Scraper	E497, N502	7.0-7.1	WN	GS	14.8	67	35	9
677	*Scraper	E503, N500	7.77	WN	LDS	8.8	36	26	8
2276	Scraper	E505, N502	7.40-7.50	WN	LDS	16.7		42	13

*Unifacial tools
**WN=Winterset
***LDS=Light-duty scraping, GS=General Scraping

Edge-Modified Debitage (n=417)

A total of 417 pieces of edge-modified debitage were recovered from 23JA155 including 375 flakes, 35 chunks and seven cores. The 417 tools exhibit 822 edge modifications (Table 36). A total of 174 tools contain a single modified edge, 137 contain two, 64 contain three, 30 contain four, 10 contain five and two contain six modified edges. In

general, there is a high correlation between overall size and the number of retouched modifications per artifact.

A total of 740 use modifications are represented. Included are 135 tools which exhibit light-duty cutting use, 69 heavy-duty cutting use, 273 light-duty scraping use, 125 heavy-duty scraping use, 84 boring/piercing and 54 graving/incising use modifications. An additional 82 non-utilized retouched edges are also present.

Lithic Manufacturing Debris

The lithic manufacturing debris includes a total of 84 cores, 2826 flakes, 434 chunks, 3584 chips and 1471 pieces of shatter. Almost all of this material is local Winterset chert. A fairly large number of the flakes have been heated.

Cores (n=84)
A total of 84 chert cores were recovered from the excavations (Table 37). None of this material has been heated. Only one core was made from a non-local tan chert, with the remainder made from local Winterset chert. The 62 cores recovered from the 1983 excavations include 14 block cores (22.6 percent), 24 tabular cores (38.7 percent), three prepared cores (4.8 percent), three core nuclei (4.8 percent), 12 core fragments (19.4 percent) and six pieces of unmodified procured raw material. The majority of the cores appear to be blocks of tabular Winterset that was initially modified and then discarded due to poor quality or obvious imperfection in the material. The large number of fragments and small number of nuclei evidence the tendency of Winterset chert to fracture along pre-existing fractures. For the most part, the small number of prepared cores and large number of tabular cores reflect the reduction of cores directly into bifacial blanks.

Chunks (n=434)
Irregularly shaped pieces of raw material with a maximum dimension of more than three cm that lack recognizable striking platforms and flake removal surfaces have been classified as chunks. All chunks from 23JA155 are Winterset chert.

Shatter (n=1471)
Irregularly shaped pieces of raw material with a maximum dimension of less than three cm that lack recognizable striking platforms and flake removal surfaces have been classified as shatter. All pieces of shatter from 23JA155 are Winterset chert.

Flakes (n=2826)
The flakes consist of non-utilized flakes or flake fragments with a maximum dimension greater than 2 cm. A total of 2826 flakes were recovered from the site. The majority of these are tertiary flakes indicating that the final stages of the lithic reduction process took place at the site. All flakes appear to be Winterset chert.

Chips (n=3584)
Chips consist of small flakes with a maximum dimension less than

Table 36. Distribution of use-wear modifications on edge-modified debitage from 23JA155.

	METERS BELOW DATUM														
	6.7-6.8	6.8-6.9	6.9-7.0	7.0-7.1	7.1-7.2	7.2-7.3	7.3-7.4	7.4-7.5	7.5-7.6	7.6-7.7	7.7-7.8	7.8-7.9	7.9-7.10	Backhoe Trench	TOTAL	Per-cent
Light-Duty Cutting			4	3	10	12	24	25	26	11	17	1	1	1	135	18.2
Heavy-Duty Cutting			1	2	1	8	5	14	12	8	12	2	2	2	69	9.3
Light-Duty Scraping	1		5	10	22	26	28	44	51	37	34	11	4	-	273	36.8
Heavy-Duty Scraping			2	4	8	9	19	22	22	20	11	6	-	2	125	16.9
Boring/Piercing				4	9	5	8	21	14	10	10	2	1	-	84	11.4
Graving/Incising			1	1	4	2	6	5	18	9	4	1	1	2	54	7.3
Total Use-Modifications	1		13	24	54	62	90	131	143	95	88	23	9	7	740	99.9
Non-utilized Retouched Edges	1		2	1	9	4	10	7	18	9	14	5	2	-	82	---
TOTAL MODIFICATIONS	2		15	25	63	66	100	138	161	104	102	28	11	7	822	---

Table 37. Descriptive data for cores and procured raw material from 23JA155.

CATALOG NUMBER	PROVENIENCE	DATUM DEPTH (m)	CORE TYPE**	CHERT TYPE	WEIGHT (g)	DIMENSIONS (mm) LENGTH	WIDTH	THICK -NESS
88-1	E501, N498	7.5-7.6		WN	61	58	44	30
108	E501, N498	7.7-7.8		WN	36	48	39	22
109	E501, N498	7.8-7.9		WN	375	110	81	49
196	North Trench	7.86		WN	180	111	63	36
267	North Trench	7.49		WN	318	86	79	65
276	E501, N501	7.47		WN	279	95	83	56
287	E501, N501	7.59		WN	423	109	81	76
295	E501, N501	7.66		WN	441	133	67	55
365	E501, N499	7.38		WN	91	64	47	35
410	E501, N499	7.84		WN	346	111	73	37
424	E499, N498	7.55		WN	65	66	43	25
425	E499, N498	7.59		WN	338	76	74	49
456	E501, N500	7.66		WN	216	101	66	37
662	E503, N500	7.57		WN	101	60	52	36
670	E503, N500	7.63		WN	50	47	42	38
688	E503, N501	7.33		WN	61	45	42	33
711	E503, N501	7.51		WN	135	57	55	42
746	East Trench	8.01		WN	1701	109	100	72
754	E499, N498	7.94		WN	79	70	51	26
763-2	East Trench	-		WN	308	85	68	50
49*	E499, N499	7.4-7.5		WN	32	46	29	25
737*	South Trench	7.40		WN	142	68	52	42
956	E497, N499	7.47	Tabular	WN	54	58	49	29
977	E497, N499	7.64	Nuclei	WN	64	60	34	25
993	E497, N499	7.74	Tabular	WN	255	79	67	36
1002	E497, N499	7.86	Block	WN	386	82	52	65
1032	E497, N500	7.5	Fragment	WN	40	40	35	27
1064*	E497, N500	7.75		WN	84	46	37	44
1110*	E497, N501	7.55	Prepared	WN	351	95	79	47
1133	E497, N501	7.70	Tabular	WN	138	73	59	31
1185	E497, N502	7.42	Tabular	WN	143	80	64	27
1186	E497, N502	7.5	Nuclei	WN	20	47	22	17
1204	E497, N502	7.62	Tabular	WN	382	120	74	48
1226	E498, N498	7.5-7.6	Fragment	WN	30	44	39	16
1288	E498, N499	7.75	Tabular	WN	261	91	87	32
1292*	E498, N499	7.77	Prepared	WN	316	83	64	54
1298	E498, N499	7.85	Fragment	WN	72	73	45	30
1310	E498, N500	7.15	Tabular	WN	41	50	43	14
1311	E498, N500	7.20	Block	NLT	486	103	72	57
1348	E498, N500	7.6	Fragment	WN	65	61	40	27
1362	E498, N500	7.7	Fragment	WN	119	69	50	36
1398	E498, N501	7.34	PRM	WN	896	131	115	57
1420	E498, N501	7.52	Tabular	WN	125	75	68	31
1430	E498, N501	7.65	Tabular	WN	101	78	68	21

continued

Table 37 continued. Descriptive data for cores and procured raw material from 23JA155.

CATALOG NUMBER	PROVENIENCE	DATUM DEPTH (m)	CORE TYPE**	CHERT TYPE**	WEIGHT (g)	DIMENSIONS (mm) LENGTH	WIDTH	THICK-NESS
1457	E498, N502	7.35	Tabular	WN	56	68	48	26
1479	E498, N502	7.64	Tabular	WN	98	72	68	28
1510	E499, N500	7.60	Tabular	WN	32	52	37	19
1596*	E499, N502	7.25	Fragment	WN	45	53	48	33
1610	E499, N502	7.56	Block	WN	213	84	73	46
1619	E499, N502	7.56	Tabular	WN	164	83	53	38
1623	E499, N502	7.61	Tabular	WN	78	84	42	31
1671	E500, N500	7.63	Block	AR	129	67	55	38
1672	E500, N500	7.61	Fragment	WN	56	59	36	24
1714	E500, N501	7.34	Block	WN	201	58	50	44
1732	E500, N501	7.55	Block	WN	63	61	51	37
1741	E500, N501	7.66	Block	WN	86	70	48	36
1797	E500, N502	7.45	Tabular	WN	93	67	53	26
1799	E500, N502	7.45	Block	WN	88	64	53	37
1806	E500, N502	7.55	Tabular	WN	99	70	44	29
1807	E500, N502	7.55	PRM	WN	111	94	58	43
1852	E501, N502	7.45	Block	WN	357	94	87	50
1861	E501, N502	7.54	Tabular	WN	166	85	79	25
1862	E501, N502	7.54	Tabular	WN	115	69	60	26
1863	E501, N502	7.57	Fragment	WN	89	58	47	27
1872	E501, N502	7.65	PRM	WN	99	74	68	21
1887	E502, N502	7.30	Tabular	WN	217	100	59	43
1893	E502, N502	7.33	Fragment	WN	54	60	42	30
1935*	E503, N502	7.43	Prepared	WN	279	91	70	48
1928	E503, N502	7.39	Tabular	WN	282	109	72	50
1990	E504, N500	7.35	Block	WN	92	61	42	34
2062	E504, N501	7.65	Tabular	WN	138	91	57	32
2067*	E504, N501	7.75	PRM	WN	514	121	109	42
2085	E504, N502	7.15	Fragment	WN	40	49	41	21
2091	E504, N502	7.29	Fragment	WN	42	48	33	24
2119	E504, N502	7.58	Tabular	WN	106	81	61	25
2166	E505, N500	7.50	Block	WN	169	82	60	43
2172	E505, N500	7.60	Block	WN	183	81	65	41
2184*	E505, N500	7.78	Block	WN	500	127	79	68
2211	E505, N501	7.35	Nuclei	AR	29	56	28	28
2228	E505, N501	7.55	PRM	WN	364	123	110	32
2246	E505, N502	7.10	PRM	WN(?)	114	75	44	43
2247	E505, N502	7.10	Tabular	WN	100	70	60	34
2255*	E505, N502	7.17	Fragment	WN	38	42	35	23
2277	E505, N502	7.42	Tabular	WN	806	130	114	53

*Hammer wear present
**PRM=Procured Raw Material
***WN=Winterset, NLT=Non-Local Tan, AR=Argentine

2 cm. All chips from 23JA155 appear to be Winterset chert.

Ground Stone Tools

Four artifacts exhibiting intentionally ground surfaces were recovered from 23JA155. Included are a small section of a metate, a mano-nutting stone, an abrader and two fragments of ground stone tools.

<u>Metate</u> (n=1)

The small section of a metate is a fine-grained sandstone cobble with a slightly concave smoothed surface on one side. The metate section has a length of 98 mm, a width of 63 mm, a thickness of 28 mm and a weight of 158 g.

<u>Mano-Nutting Stone</u> (n=1)

The mano-nutting stone is a circular fine-grained sandstone cobble with a smooth rounded surface on one side and a circular pecked depression on the other side (Figure 25a). The mano-nutting stone is 120 mm in length, 101 mm in width, 33 mm in thickness and has a weight of 324.5 g.

<u>Abrader</u> (n=1)

The small abrader is made of a fine-grained sandstone, has a smoothed surface on one side and a wide U-shaped groove on the opposite face (Figure 25b). The abrader is 45 mm in length, 30 mm in width, and 13 mm in thickness and has a weight of 11.6 g.

<u>Ground Stone Fragments</u> (n=2)

One broken ground stone fragment is a fine-grained sandstone cobble with a smooth rounded surface. The fragment is probably a section of a mano. The second is a small fragment made from bluish-gray sandstone which has one ground surface and is either a section of a metate or an abrader. It has a length of 28 mm, a width of 17 mm, a thickness of 12 mm and a weight of 4.3 g.

Minerals

A total of 152 minerals were recovered from 23JA155. Included are 11 pieces of yellowish-brown limonite, 127 pieces of soft reddish-yellow hematite and three pieces of purplish-red hematite. Additionally, 11 samples of ocher consisting of ground hematite or limonite mixed with soil were recovered. The 11 pieces of limonite have a combined weight of 88.5 g with individual weights ranging from 1.4 to 49.2 g. The 127 pieces of soft hematite are smaller, having a combined weight of 193.3 g and ranging from 0.1 to 11.3 g in weight. The three pieces of hard hematite have a combined weight of 35.9 g and range individually from 10.3 to 14.5 g.

Kopsick (1982) has noted that both limonite and soft reddish-yellow hematite occur locally in the Kansas City group limestones. The harder purplish-red pieces of hematite are not known to occur locally and likely are imported. Close sources of this material would be the Pomme

de Terre valley in west central Missouri (Behm 1982).

Unworked Stone

A total of 181 unworked stones were recovered from the excavations. A large amount of rock debris under 3 cm in diameter was also encountered in the excavation. This material is almost entirely natural in origin and was discarded during the 1983 excavation. Distribution of the 181 pieces of heated and unheated unworked stone by lithology is presented in Table 38. Included are 50 pieces of heated limestone, cherty limestone or sandstone which probably represent discarded hearthstones or hearth stone fragments. The unheated unworked stone include an additional 77 pieces of limestone, cherty limestone and sandstone as well as 54 pieces chert. Most of the chert does not appear suitable for tool manufacture.

FAUNAL REMAINS

The faunal remains recovered from 23JA155 primarily consist of small fragments of unidentifiable burnt bone. The entire sample consists of 648 small fragments which have a combined weight of only 86.4 g (Table 39). Of this number, only 22 fragments are identifiable. Included are four fragments identifiable as deer (Odocoileus sp.) and 19 identifiable as turtle (Testudinoid).

The deer remains included three molars and a pisiform. Two of the molars are badly fragmented. The turtle remains consist of small sections of the carapace, all of which are burnt white. While the turtle remains were not identifiable to a specific level, they closely resemble box turtle (Terrapene sp.). The large number of unidentified remains consist almost entirely of small sections of burnt bone. The majority of these appear to be from large mammals, and probably are deer bones. At least one small mammal or a bird is also represented.

FLORAL REMAINS

A limited number of floral remains were recovered from flotation samples taken during the excavations at 23JA155. Included are 16 identifiable seeds and eight unidentifiable nutshell fragments. The relative paucity of floral remains may result from preservation factors, but more likely indicates minimal usage of these resources by the inhabitants at this site.

The identifiable carbonized seeds are represented four specimens belonging to the genus Chenopodium. Chenopods are annual plants, 60-100 cm in height, which have flowers and fruits in thick spikes. Thousands of seeds, which are available from September through October, are

Table 38. Distribution of unworked stone from the block excavations at 23JA155.

	METERS BELOW DATUM																
	6.6-6.7	6.7-6.8	6.8-6.9	6.9-7.0	7.0-7.1	7.1-7.2	7.2-7.3	7.3-7.4	7.4-7.5	7.5-7.6	7.6-7.7	7.7-7.8	7.8-7.9	7.9-8.0	8.0-8.1	BACKHOE TRENCH	SITE TOTAL
HEATED																	
Limestone		1	1		5	7		4	3	4	3	8	1		1		38
Cherty Limestone					1				1			1					3
Sandstone							1		6	1		1					9
Chert																	
Total		1	1		6	7	1	4	10	5	3	10	1		1		50
UNHEATED																	
Limestone		1	5	1	2	3	1	1	6	2		4	1				27
Cherty Limestone	2		1	1	9	6			6	2	3	2	3		2		37
Sandstone						1	3		5	2	2						13
Chert		2	9	1	2	9	5	4	8	2		5	3			4	54
Total	2	3	15	3	13	19	9	5	25	8	5	11	7		2	4	131
TOTAL	2	4	16	3	19	26	10	9	35	13	8	21	8		3	4	181

Table 39. Faunal remains recovered from 23JA155.

	EXCAVATION LEVEL														
	METERS BELOW DATUM														
	6.9- 7.0	7.0- 7.1	7.1- 7.2	7.2- 7.3	7.3- 7.4	7.4- 7.5	7.5- 7.6	7.6- 7.7	7.7- 7.8	7.8- 7.9	7.9- 8.0	8.0- 8.1	East Trench	South Trench	TOTAL
IDENTIFIED															
Odocoileus sp.							1			3					4
Testudinoid						8	1	4	6						19
Total						8	2	4	6	3					23
UNIDENTIFIED	2	1	14	20	53	75	119	182	74	41	15	10	10	16	625
TOTAL*	2	1	14	20	53	83	121	186	80	44	15	10	10	16	648

*Number of fragments.

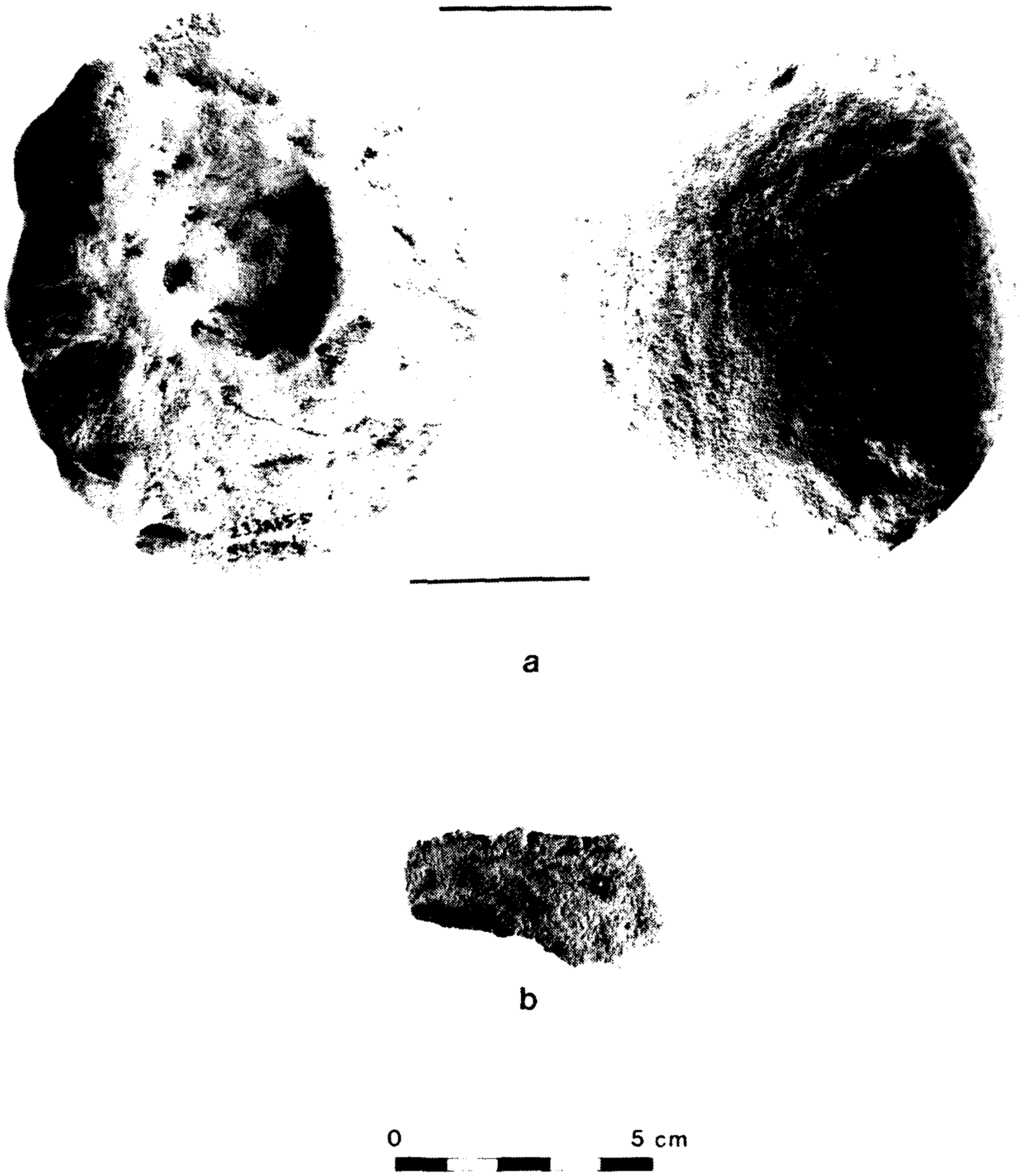


Figure 25. Ground stone tools from 23JA155; a mano-nutting stone; b, abrader.

produced by each plant. These drop to the ground and are easily moved about by wind and water.

According to Steyermark (1963), 17 species of *Chenopodium* presently occur in Missouri. However, only three native species are fairly common. C. *standleyanum* (goosefoot) occurs in dry or moist soil, shaded woodlands, thickets, rocky or rich ground, ledges or bluffs. *C. album* (lamb's quarters) occurs in waste and cultivated ground. *C. hybridum* (maple-leaf goosefoot) occurs in rich, open soils, woodlands, along shaded ledges, slopes and bluffs.

DISCUSSION AND SUMMARY

The Cold Clay site (23JA155) consists of a buried late Middle Archaic occupation located on the T-1 terrace of the East Fork of the Little Blue River in Jackson County, Missouri. The location of the site is near the headwaters of the Little Blue River on soils mapped as the Bremer Series. Site testing in 1977 produced evidence of a shallow Late Archaic or Woodland component. Further testing in 1979 indicated that this component had minimal content. However, backhoe trenching located a deeply buried Archaic component consisting of a thick cultural stratum located in the T-1 terrace fill.

Soil-geomorphic investigations indicate that the T-1 terrace fill at Cold Clay consists of two alluvial units referred to as Units A and B. Unit B contains the upper cultural component and extends from the surface to a depth of 70 cm. The Unit B sediments consist of a brown-dark gray silt loam with a weakly developed soil structure. The underlying Unit A deposit is a mottled gray-brown silty clay loam, capped by a dark gray paleosol with moderately developed soil structure. Humic acids in this paleosol have been dated at 4245±170 years B.P., indicating that Unit A accumulated during the mid-Holocene. This period of alluviation terminated in a period of depositional stability on the floodplain of the Little Blue River by 4200 B.P.

Underlying the Unit A paleosol is a bed of coarse gravel representing a period of colluviation and erosion from the adjacent hillside. The buried Archaic cultural deposit is located below this gravel lens and consists of a cultural stratum approximately 50 cm in thickness which gently dips to the south. This deposit contains a scatter of broken tools, lithic manufacturing debris, small fragments of burnt bone, and flecks of charcoal. Cultural material has been vertically displaced upward and downward from this stratum by crayfish bioturbation. Crotovinas representing former crayfish burrows extend from the paleosol downward through the cultural deposit resulting in the displacement of artifacts. This displacement and movement appears to have been primarily vertical rather than horizontal. Radiocarbon dates from the buried cultural deposit range from 5550-5590 years B.P. The two more recent dates obtained during the 1979 test excavations appear to have been contaminated by more recent humic acids or by bioturbation.

The artifact assemblage includes a restricted range of formal chipped stone tools including 12 projectile points, two bifacial knives, 50 blanks and preforms, a bifacial scraper, two unifacial scrapers, two flake scrapers and 417 pieces of utilized edge-modified debitage. A considerable amount of lithic manufacturing debris including cores, chunks, shatter, flakes and chips is also present. Minerals which are suitable for pigment manufacture are also present in quantity. A number of unworked stones or manuports are present. Heated unworked stone that is present appears to represent hearthstones or hearth cleaning debris.

The relative frequencies of the various activities that took place at the site can be inferred from the frequencies of the various tools present in the assemblage and from the use-wear analysis. The 71 formal tools include a total of 12 projectile points, two bifacial knives, one bifacial scraper, 50 blanks and preforms, two unifacial scrapers and two flake scrapers, one metate, one mano-nutting stone and one abrader. The frequencies of the formal tools suggest that important activities included hunting and butchering and chipped stone tool manufacture. Chipped stone tool manufacture is evidenced by the considerable amount of debitage recovered (186.6 pieces per sq m excavated) and by the ten cores with evidence of hammer wear.

The results of the use-wear analysis for both the formal tools and edge-modified tools are summarized in Table 40. The majority of the formal tools (37.2 percent) exhibit use-wear consisting of general cutting (both light and heavy-duty) activities. An additional 11.6 percent exhibit heavy-duty cutting use, while 14 percent exhibit general scraping use, 18.6 percent show light-duty scraping use and 7.0 percent exhibit heavy-duty scraping use. A number (11.6 percent) exhibit graving/incising use.

The results of the use-wear analysis of the edge-modified debitage indicate that scraping wear (both light and heavy-duty) accounts for over half of the use modifications (53.8 percent). Light and heavy-duty cutting represents 27.5 percent of the use modification. Boring/piercing and graving/incising represent 11.4 percent and 7.3 percent, respectively. Overall, light-duty modifications, including light-duty cutting, light-duty scraping and boring/piercing, represent 66.5 percent of the activities indicating that the majority of the materials being worked were relatively soft. Heavy-duty cutting and scraping and engraving/incising account for 33.5 percent of the use modification indicating that a fair percentage of hard materials were also worked. Overall then, the use-wear characteristics of the assemblage from 23JA155 are dominated by tools which exhibit scraper use (53.1 percent), although a fair number of cutting tools are also present, as are a number of graving/incising and boring/piercing tools.

Faunal remains recovered from the site indicate the exploitation of primarily white-tailed deer, although smaller species, such as turtles, were also utilized. The presence of a turtle also suggests that the site was occupied during the warm season as turtles are active from April through October (Collins 1974). Floral remains recovered from 23JA155 indicate the exploitation of disturbed forest community species, such as chenopods. The season of availability of these species

evidences occupation of the site during the fall months of September through mid-November.

Based on the information recovered from the site, the buried Archaic component appears to have been a relatively small campsite occupied by late Middle Archaic hunter-gatherers. The exact size of the site has not been determined due to its buried condition. While no features were located, the presence of scattered charcoal in the midden and burnt hearthstones indicate the presence of nearby hearths. The overall distribution of debris from the site illustrates an even concentrated distribution of debris throughout the excavation except for the southeastern corner. Cores and blanks appear fairly evenly distributed across the excavation. The distribution of unmapped debitage (including modified debitage) includes a high to medium concentration in the northeastern corner and a moderate distribution in the western portion of the excavation. Low densities are found along the southern and southeastern boundaries. Formal tools are most concentrated in the western part of the excavation. Tools located in this area include a cluster of six points and five preforms in the west central part of the area, a cluster of three points along the western edge and two scrapers and two preforms in the northeastern corner. The eastern side of the excavation includes three scrapers in the northeastern section and five points in the southwestern corner.

The overall density, lack of features and types of material recovered suggest that the areas of the site excavated within Block B represent a midden or refuse area rather than a primary activity area. Interpretation of the spatial distribution of debris is limited by the small size of the excavation. Excavation of broader areas of the site would clarify interpretations regarding the function of the site.

Perhaps the most important activity that took place at the site was the procurement of chert from the Winterset limestone formation above the site and the manufacture of chipped stone tools. The large percentage of tertiary flakes and chips in the debitage sample suggests that final stage lithic reduction took place at the site. This is confirmed by the low percentage of chunks and shatter present in the sample. Initial stage reduction of Winterset chert probably occurred on the hilltop above 23JA155 where the Winterset chert was procured.

The location of the nearby Winterset chert outcrops, which provided easy access to quantities of raw materials, may have played an important part in the selection of Cold Clay as a campsite. Another factor may have been the availability of spring water. The Pleasanton shale which underlies 23JA155 locally contains a sandy unit known as the Knobtown facies which produces water throughout the year.

The Middle Archaic period in the Kansas City area is relatively unknown. Most of the Archaic sites that have been investigated can be assigned to the Late Archaic Nebo Hill phase (Reid 1983, Reeder 1981). Radiocarbon dates for Nebo Hill components range from approximately 3000-4500 years B.P. (Schmits and Wright 1982). 23JA155 has been dated at 5550 to 5590 years B.P. indicating a temporal position prior to Nebo Hill occupations of the area.

Table 40. Use-wear modifications on formal chipped stone tools from 23JA155.

	GENERAL CUTTING	LIGHT-DUTY CUTTING	HEAVY-DUTY CUTTING	GENERAL SCRAPING	LIGHT-DUTY SCRAPING	HEAVY-DUTY SCRAPING	GRAVING/ INCISING	BORING/ PIERCING	TOTAL USE MOD.	TOTAL TOOLS
FORMAL TOOLS										
Projectile Points	4		2						6	12
Bifacial Knives	2								2	2
Preforms							1		1	10
Bifacial Blanks	5		1	2	5	2	3		18	36
Bifacial Fragments	5		2	2		1	1		11	47
Scraper				1					1	1
Flake Scrapers				1	3				4	4
Total	16		5	6	8	3	5		43	112
Percent	37.2		11.6	14.0	18.6	7.0	11.6		100.0	
EDGE-MODIFIED DEBITAGE		135	69		273	125	54	84	740	
Percent		18.2	9.3		36.9	16.9	7.3	11.4	100.0	
TOTAL	16	135	74	6	281	128	59	84	783	112
PERCENT	2.0	17.2	9.5	0.8	35.9	16.4	7.5	10.7	100	

The data recovered from Cold Clay indicates the presence of a previously unknown late Middle Archaic cultural unit in the Little Blue River valley which is presently designated as the Jacomo phase. This cultural complex is characterized by a heterogeneous projectile point assemblage including a combination of corner-notched, straight stemmed and expanding stemmed points. One side-notched point and one lanceolate point are also present in the assemblage from Cold Clay.

The Middle Archaic burials at 23JA277, located just downstream from 23JA155, date to 5420±210 years B.P. and are also included within the Jacomo phase. The burials at 23JA277 were discovered exposed along a diversion channel just east of the East Fork of the Little Blue River at a depth of approximately four meters below the surface. Osteological analysis of the human remains from the site (Baker et al. 1965) indicate the presence of at least three individuals including a male in excess of 55-65 years at the time of death and two females in excess of 18 years of age. Available evidence indicates that these individuals were buried in a flexed position, possibly in a pit.

The assemblage from 23JA155 shows a number of striking similarities to some of the Middle Archaic and transitional Middle-Late Archaic assemblages to the east in western Illinois and central Missouri. Notable examples in central Missouri include the Perche Creek site, an early Middle Archaic site dating from 6600-7000 years B.P., which is characterized by notched and stemmed points (Schmits 1985). 23BO971, also located along the Perche-Hinkson drainage of central Missouri, contains a combination of corner-notched, expanding stemmed and straight stemmed points (Reeder et al. 1983). Radiocarbon dates from the site range from 4200-4510 B.P. The expanding stemmed points from Cold Clay are also similar to to those from late Middle Archaic complexes in western Illinois including the Helton phase (Cook 1976). There also are some similarities with notched and expanding stemmed points at the Coffey site in northeastern Kansas (Schmits 1978, 1981).

Another characteristic of the Jacomo phase assemblage at Cold Clay is the relatively high percentage of heat treatment among the bifacial tools. For example, five of the 12 projectile points have been heated. Eighteen of the 99 unstemmed bifaces have also been heated. A relatively high percentage of heat treatment has been noted at both the Perche Creek site (Schmits 1985) and at 23BO971 (Reeder et al. 1983) and Heat treatment has been pointed out as being a diagnostic trait of the central Missouri Middle Archaic sites (Schmits and Bailey 1985a). An emphasis on heat treatment is also one of the hallmarks distinguishing the Helton phase from the late Late Archaic Titterington phase in western Illinois (Cook 1976, Fortier 1983).

In summary, the Cold Clay site represents a late Middle Archaic specialized Jacomo phase residential occupation focused primarily on lithic tool manufacture and pigment processing. The site was most likely occupied during the warm season and probably during the summer and fall. The site is representative of a previously undefined late Middle Archaic cultural unit, referred to as the Jacomo phase, that appears to have a cultural relationship with Archaic complexes to the east in central Missouri and western Illinois.

CHAPTER VII

THE BLACK BELLY SITE (23JA238)

Larry J. Schmits

INTRODUCTION

23JA238 is located along the north side of a meander of the East Fork of the Little Blue River (Figure 26). The site was discovered in December of 1978 during an inspection of the cutbank along the river. Artifacts eroding from the bank including a corner-notched dart point, a cordmarked body sherd and lithic manufacturing debris indicated the presence of a thick buried cultural deposit of potential significance. Phase II test excavations were conducted at the site in 1979 by Soil Systems, Inc. (Schmits and Reust 1982b). The results of this work indicated the presence of Mississippian period May Brook phase and Middle Woodland components. Due to the limited information available for these periods in the Little Blue valley, the site was considered to be significant. It was therefore recommended that the site be either preserved or that data recovery investigations be conducted prior to completion of the construction of Blue Springs Lake. Since the site will be inundated once Blue Springs Lake is filled, an extensive data recovery program was carried out at the site by Environmental Systems Analysis, Inc. in 1983-1984.

DESCRIPTION OF THE EXCAVATIONS

The 1979 test excavations consisted of two test blocks and three one by two m test units (Figure 27). These investigations focused on limited data recovery of the deposits eroding from the river bank since it was not certain that further work would be conducted at the site. Test Block A, consisting of a two by four m block excavation, was opened along the cutbank where evidence of the buried deposits had first been discovered. These excavations were taken to a depth of 1.6 m below the surface and revealed a thin scatter of cultural debris including some historic artifacts from the surface to a depth of 70 cm. A concentrated cultural stratum was encountered at 90 cm below the surface and extended to a depth of 150 cm. Little or no material was encountered below this depth. The cultural deposit appeared to be located on an older surface defined by a more highly developed soil. Artifacts recovered include small arrow points and grog tempered ceramics, indicating a May Brook phase cultural affiliation.

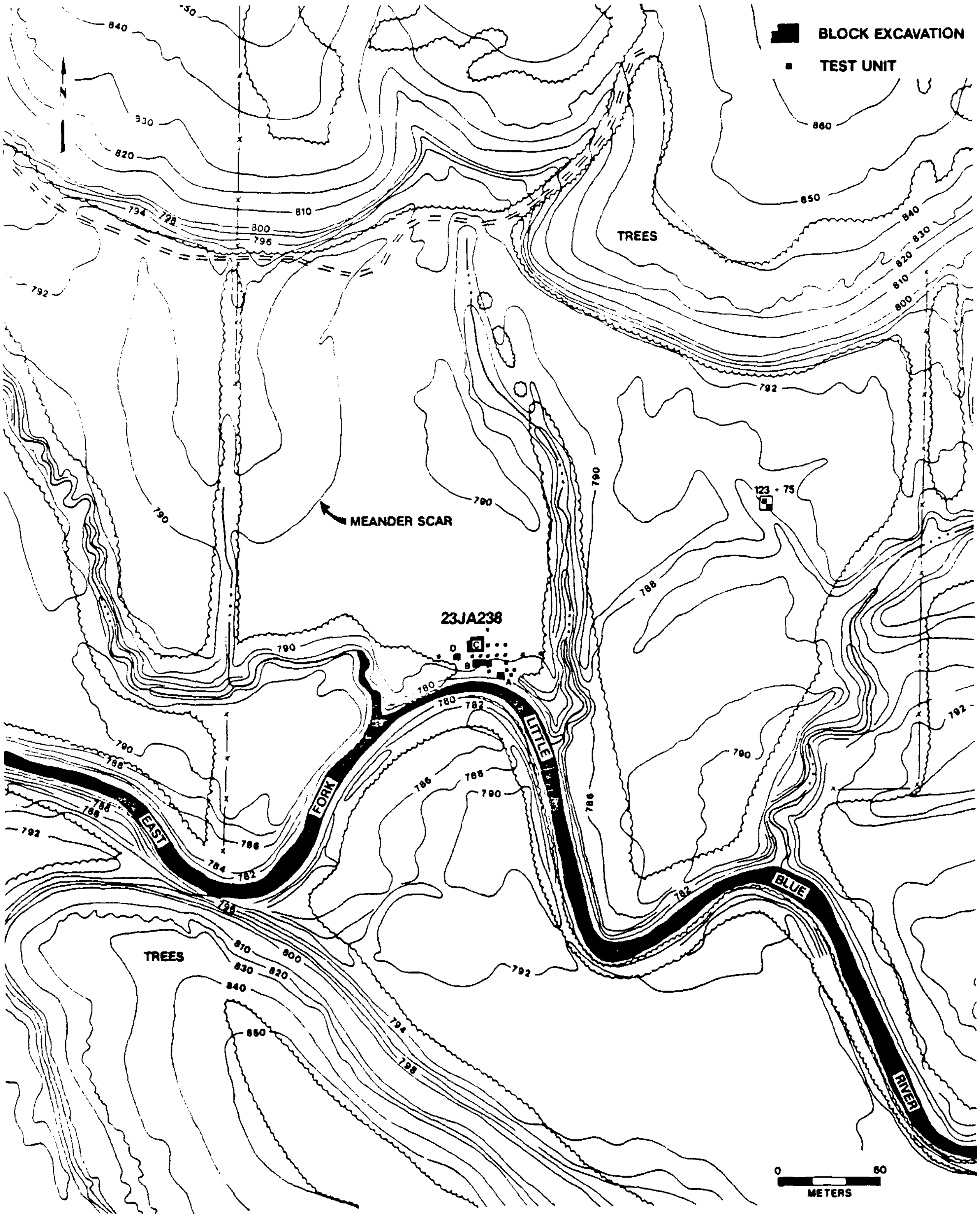


Figure 26. Location of the 1979 to 1984 excavations at 23JA238.

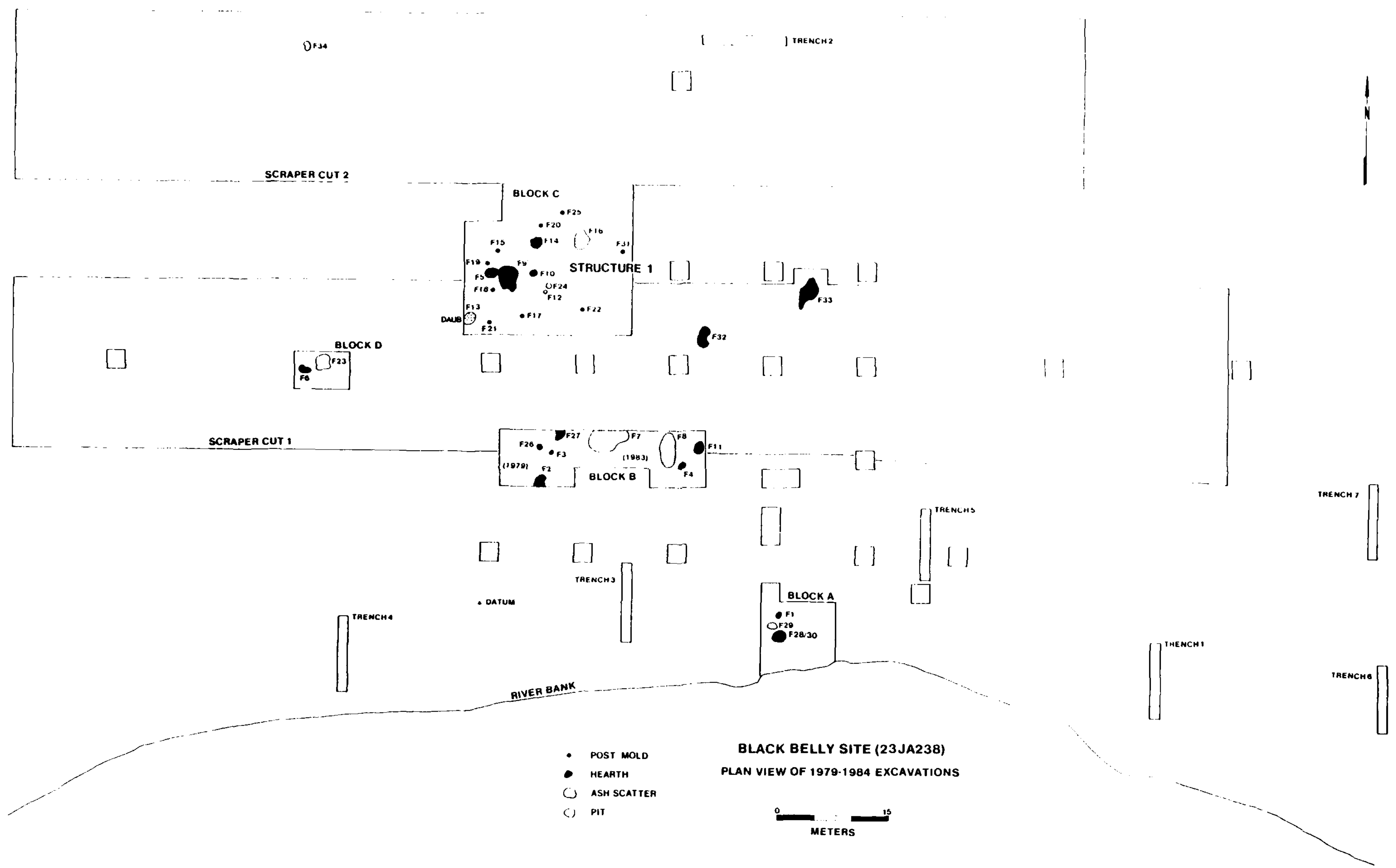


Figure 27. Plan view of the excavations and features at 23JA238.

In order to determine the northern extent of this buried cultural deposit, a transect of three test units was laid out on a north-south axis immediately north of Block A (Figure 27). The first two units (Test Units 1 and 2) were taken to a depth of 130 cm below surface. Concentrated cultural materials were encountered from 30-70 cm below the surface although no ceramics or other diagnostic artifacts were recovered from either of these units. While the presence of an older surface could not be defined in Test Units 1 or 2, the concentration of cultural deposits noted at 90-150 cm in Test Block A appeared to be located nearer to the surface in Test Units 1 and 2 suggesting that the cultural occupation was located on a former surface that sloped to the south.

A third test pit, Test Unit 3, was located north of Test Unit 1 and was taken to a depth of 80 cm below the surface. A concentrated zone of cultural deposits was located at 40-60 cm below the surface. However, materials recovered from this zone included a contracting stemmed Langtry point indicating a Woodland cultural affiliation for the deposits and suggesting that the site contained multiple components. A fourth test unit was located 14 m west of Test Unit 1 and encountered a concentrated cultural zone at 30-90 cm below the surface. This deposit contained a thin scatter of charcoal mixed with Woodland artifacts. The test unit was then expanded into a two by three m block (1979 Block B) to recover an additional sample of diagnostic material and sufficient charcoal for radiometric dating.

In summary, the 1979 test excavations at 23JA238 indicated the presence of two components: a Mississippian period May Brook phase occupation similar to that encountered at the May Brook site (Schmits 1980b) and an earlier Middle Woodland period occupation. The May Brook component was concentrated along the river bank from 80-135 cm below the surface, while the Woodland component was located about ten m north of the river bank. Based on the results of the 1979 work, the site was considered to be significant and recommendations were made for preservation or data recovery if preservation was not feasible (Schmits and Reust 1982b).

The 1983 data recovery program at 23JA238 consisted of an initial testing program designed to define the boundaries of the site and to locate concentrations of debris suitable for intensive excavation. The work commenced with the clearing of high weed cover and the reestablishment of the 1979 grid system. The testing strategy consisted of the excavation of a series of one by one m test units placed initially at 5 m intervals over the site (Figure 27). As artifact densities decreased near the site's periphery, the test unit interval was increased to 10 m. The testing also indicated the presence of a third previously undefined Late Woodland component located at a depth of 0-40 cm below the surface north of the Middle Woodland component that had been initially defined during the 1979 test excavations.

This initial 1983 testing was followed by the excavation of four blocks situated so as to sample all three components at the site. Block A consisted of an expansion of the 1979 Test Block A that focused on the May Brook phase component (Figure 28). This expansion of Block

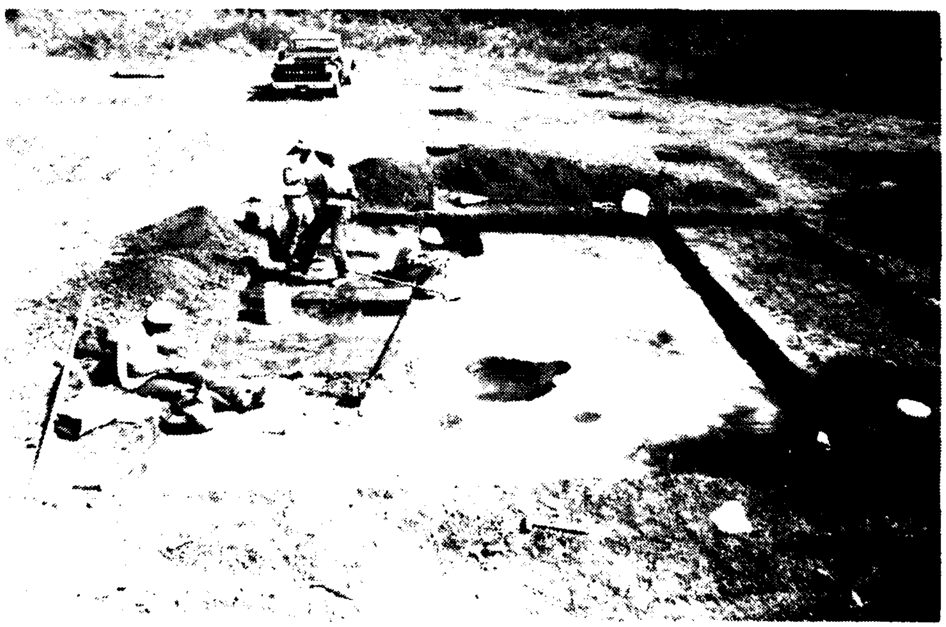


Figure 28. General views of the 1983 excavations at 23JA238. Block A (upper) and Block C (lower).

A located an additional three features (Features 28, 29 and 30) including a burnt rock hearth, a charcoal concentration and a dense charcoal lense. Profiles of the east and west walls of Block A showed little cultural material and few artifacts indicating that the May Brook phase occupation was of limited extent and that most of the material had been recovered. This component undoubtedly used to extend further to the south, but has been destroyed by meandering of the Little Blue River.

The 1983 excavation of Block B initially began as an expansion of a test unit northwest of Block A which had encountered a small burnt rock feature. The excavation was expanded to the west and ultimately was connected with the 1979 Test Block B. Cultural material was encountered from the surface to a depth of 70 cm but was most concentrated from 50-70 cm below the surface. The excavation of Block B located eight features (Features 2, 3, 4, 7, 8, 11, 26, 27) in addition to a substantial artifact assemblage associated with the Middle Woodland component at the site. Diagnostic artifacts from the Middle Woodland component in Block B include contracting stemmed Langtry points and thick grit tempered ceramics. Some Late Woodland artifacts were also recovered from the upper 30 cm of the Block B deposits.

Block C was located north of Block B and focused on the Late Woodland deposit at the site (Figure 28). Cultural materials were found to be concentrated between 20 and 35 cm below the surface and excavations in Block C were taken to a depth of 40 cm below surface. A total of 16 features were located in Block C (Features 5, 9, 10, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25 and 31), including post molds, trash filled pits, burnt rock hearths and charcoal concentrations. The distribution of post molds and other features and concentrations of artifacts in Block C indicate the presence of a habitational structure designated as Structure 1. Diagnostic artifacts from Block C included Steuben points and thin ceramics tempered with fine sand or grit. Other chipped stone tools, animal bone and limited amounts of lithic manufacturing debris were also recovered. Most of this material was from the pits and little evidence of a midden was encountered on the floor or outside the structure.

Block D consisted of a 2 by 3 m area expanded around Feature 6, a small burnt rock hearth that was defined during the initial testing. Thin sand or grit tempered ceramics, chipped stone tools and a larger amount of lithic manufacturing debris were also recovered. This material was from the upper 40 cm indicating an association with the Late Woodland occupation defined in Block C. A second feature consisting of a clay filled basin was also located in Block D.

Subsequent to the completion of the 1983 excavations, limited work was conducted at the site in September of 1984. This work consisted of the excavation of two scraper cuts referred to as Scraper Cuts 1 and 2. The scraper cuts were taken to a depth of 25-30 cm and designed to expose any additional Late Woodland cultural features. Scraper Cut 1 located two hearths east of Block C (Features 32 and 33). A small charcoal scatter (Feature 33) was located northwest of Block C in Scraper Cut 2. A series of seven backhoe trenches were also cut around

the periphery of the site. These were cut to provide additional exposures for soil geomorphic investigations and to determine if any refuse might be present near the site periphery. Minimal cultural material was recovered from the trenches.

The combined results of the 1979 and 1983-1984 excavations at 23JA238 resulted in the definition of three components at the site including Middle Woodland, Late Woodland and May Brook phase occupations. These components are primarily defined by their horizontal position in the site although the vertical position of each varied in terms of depth and soil stratigraphic association. The Middle Woodland component was primarily defined at a depth of 40-70 cm below the surface in Block B, in the three test units immediately to the north and the three test units immediately to the south of the block, as well as in test units to the east of Blocks B and C. The Late Woodland deposit was primarily concentrated in the upper 40 cm of Blocks C and D and in test units between and east of Blocks B and C. The May Brook phase component was restricted to Block A at a depth of 90-150 cm below the surface and to deposits from 60-80 cm below the surface in three test units northeast of Block A (Figure 28). The upper part of Block A, as well as the one by two m test unit immediately to the north and the deposits above 60 cm in the three test units northeast of Block A, consist of a mixture of prehistoric and historic artifacts which appear to be out of context and have been designated as mixed or unknown.

The 1979-1984 excavation methodology employed at 23JA238 primarily consisted of shovel skimming and trowelling. Vertical control consisted of 10 cm levels, except for the upper 20 cm of the plowzone which was excavated as a unit. Chipped stone tools, ceramics, cores and burnt rock larger than 5 cm in maximum dimension were mapped to the nearest cm. All vertical elevations were recorded in reference to an arbitrary datum. Due to the complexities in cultural and natural stratigraphy at the site, all depths were recorded relative to an arbitrary datum. Level summary forms were completed for each unit and level excavated. Feature data forms were completed for all features encountered. Features were also mapped and photographed.

A total of 5973 artifacts were recovered during the 1979-1984 excavations at 23JA238. Included are 245 ceramic sherds, 297 chipped stone tools, 25 cores, 3846 pieces of debitage, two ground stone tools, 11 minerals, 773 unworked stones, 667 unworked bones and 107 carbonized nutshells. The distribution of this debris by provenience is presented in Table 41.

Soil samples were systematically collected from the site for flotation. Samples collected include the entire matrix from each feature. Samples were also collected from the non-feature excavation levels. In general, samples were collected from the two 10 cm levels in each unit that contained the most concentrated cultural deposit. The flotation samples recovered from the features have been analyzed and are included within the present analysis. The non-feature samples have been processed but have not been sorted or analyzed. Inspection of these samples indicated that minimal amounts of organic faunal and floral remains are present.

Table 41. Distribution of artifacts recovered from 23JA238.

	BLOCK EXCAVATIONS A	B	C	D	TEST UNITS	SCRAPER CUTS	CUT-BANK	TOTAL
Ceramics	14	63	134	2	30		2	245
Chipped Stone Tools	37	158	36	8	52	4	2	297
Ground Stone Tools		2						2
Cores	3	11	8		2	1		25
Debitage	136	2565	230	108	774	29		3846
Minerals		6	2		3			11
Unworked Stone	26	77	251	17	107	295		773
Unworked Bone	15	226	299	38	83	6		667
Carbonized Nutshells			107					107
TOTAL	231	3108	1067	173	1051	335	8	5973
PERCENT	3.9	52.0	17.9	2.9	17.6	5.6	0.1	100.0

GEOMORPHOLOGY AND STRATIGRAPHY

The valley of the East Fork of the Little Blue River is about 440 meters in width in the vicinity of 23JA238. Based on map and air photo interpretations, at least two terrace surfaces are present in the area of the site. The lower T-0 terrace is present in several areas just to the south of the present channel. The higher T-1 terrace comprises the greater portion of the floodplain surface and exhibits numerous depressional areas resulting from previous meandering of the Little Blue River. As noted in Chapter 2, aggradation of the T-1 terrace in the Little Blue valley ceased at approximately 2000 years B.P. This date is confirmed by wood secured at a depth of 2.5 m below the surface from an oxbow pond approximately 150 m northwest of 23JA238 which has been dated at 1460±55 years B.P. This date indicates that the old T-1 meanders were filling during Middle Woodland times.

Based on the profiles exposed by the excavation and backhoe trenches, the stratigraphy of the site consists of two major depositional units, referred to as Units A and B. The uppermost, Unit B, is recently deposited silty alluvium which forms a levee on the

surface of the T-1 terrace. This wedge-shaped deposit is approximately 30 cm thick near the streambank, and rapidly thins away from the Little Blue River. The A-C soil profile in this deposit is characterized by poor structural development and a high organic carbon content (Tables 42 and 43).

In Trench 1, which is located approximately 3 m north of the stream channel (Figure 28), the contact of Unit A with Unit B is marked by

Table 42. Soil description of Backhoe Trench 1 at [illegible]JA238.

DEPOSITIONAL UNIT	SOIL HORIZON	DEPTH (cm)	DESCRIPTION
B	Ap	0-20	Very dark grayish brown (10YR3/2) silt loam, grayish brown (10YR5/2) dry; weak fine platy structure parting to weak fine granular; friable; common fine roots; slightly acid; abrupt smooth boundary.
B	C	20-30	Very dark grayish brown (10YR3/2) silt loam, grayish brown (10YR5/2) dry; weak fine platy structure parting to weak fine granular; friable, common fine roots; few fine pores; slightly acid: abrupt smooth boundary.
A	2Bw1b	30-110	Very dark grayish brown (10YR3/2) silty clay loam, dark grayish brown (10YR4/2) dry; moderate fine subangular block structure; firm; few light brownish gray (10YR6/2) silt coatings on faces of peds; common fine pores; slightly acid; common flecks of charcoal in lower 50 cm; gradual smooth boundary.
A	2Bw2b	110-195	Brown (10YR4/3) silty clay loam, brown (10YR5/3) dry; common fine dark yellowish brown (10YR4/4) and brownish yellow (10YR6/8) mottles; moderate fine subangular blocky structure; common fine pores; medium acid.

sharp textural and structural changes (Tables 42 and 43). Clay content increases from 19 percent in Unit B to 30 percent in the upper 30 cm of Unit A. There is also an abrupt change from weak granular structure in Unit B to moderate subangular blocky structure in Unit A.

Trench 2, which is located approximately 85 meters north of the stream channel, revealed a depositional sequence similar to the one in Trench 1. However, Unit B is 10 cm thinner and is composed of a greater percentage of clay than Trench 1. These differences can be explained by the fact that Unit B is a levee deposit which becomes thinner and finer textured with increasing distance from the channel.

Table 43. Physical and chemical properties of soils from Backhoe Trench 1 at 23JA238.

DEPOSITIONAL UNIT	SOIL HORIZON	SAMPLE DEPTH	GRAIN SIZE DISTRIBUTION Sand(%)	Silt (%)	Clay (%)	pH	ORGANIC CARBON (%)
B	Ap	10-20	15	66	19	6.3	5.3
B	C	20-30	14	67	19	6.2	2.1
A	2Bw1b	30-50	14	56	30	6.2	2.7
A	2Bw2b	130-160	15	56	29	6.0	0.9

The presence of a cambic (Bw) horizon in Unit A indicates that the T-1 surface has been relatively stable, allowing a moderately developed soil to form in the alluvium. This period of stability was interrupted by an episode of erosion, which resulted in the truncation of the Bw horizon. Recent overbank deposition resulted in burial of the truncated soil on the T-1 surface. This soil is represented by the Bw1b horizon in Unit A.

RADIOCARBON DATES

A total of five radiocarbon dates are available from 23JA238 (Table 44). All dates are on wood charcoal and are based on a half life of 5568 years. Two dates of 1620±45 (DIC-1680) and 1960±90 (Beta-8537) years B.P. are from the Middle Woodland deposits in Block B. DIC-1680 was obtained at a depth of 50-88 cm below the surface in the southwestern corner of the block. Beta-8537 was obtained at 60-70 cm below the surface in Feature 7. The average of these two dates is 1790 years B.P. (A.D. 160).

Two dates of 1310±60 and 1390±60 years B.P. (Beta-8538 and Beta-

12786) were obtained from the Late Woodland deposit in Block C. Beta-8538 was recovered from Feature 12 at a depth of 36-40 cm below the surface. Beta-12786 was recovered from 31-56 cm below the surface in Feature 16. One date of 680±65 years B.P. is also available from the May Brook phase deposits in Block A. The sample was obtained from the southwestern corner of Block A at a depth of 130 cm below the surface.

Table 44. Radiocarbon dates from 23JA238.

SAMPLE NUMBER	LAB NUMBER	PROVENIENCE	COMPONENT	DATUM DEPTH (m)	DATE B.P.
JA238-1	DIC-1603	E101,N100	May Brook Phase	2.80-2.90	680±65
JA238-2	DIC-1680	E88,N110	Middle Woodland	1.86-2.21	1620±45
JA238-3	Beta-8537	Feature 7	Middle Woodland	2.05-2.15	1960±90
JA238-4	Beta-8538	Feature 12	Late Woodland	1.76-1.80	1310±60
JA238-5	Beta-12786	Feature 16	Late Woodland	1.69-1.94	1390±60

CULTURAL FEATURES AND ARCHITECTURAL REMAINS

A total of 30 cultural features were located as a result of the 1979 and 1983-84 investigations at 23JA238 (Figure 28). Features 1-3 were defined during the 1979 test excavations and Features 4-23 and 25-34 were located during the 1983-1984 investigations. Features 12 and 24 were determined to be a single feature upon excavation. The features from 23JA238 include two pits, nine post molds, seven burnt rock hearths, concentrations of burnt clay, charcoal concentrations and concentrations of cultural debris. The matrix of all features were floated and water screened. The micro-debris recovered is presented in Table 45.

Middle Woodland Component

Eight features including Features 2, 3, 4, 7, 8, 11, 26 and 27 are associated with the Middle Woodland component (Figure 29a-d). Included are three small rock hearths, three hearths, one trash heap and an ash stain.

Feature 2: A basin-shaped hearth located in Block B. The hearth was 74 cm in length and 60 cm in width. It was first encountered at 58 cm below surface and extended to a depth of 81 cm below surface. The fill consisted of six heated limestone rocks and a heavy concentration of burnt clay. Flotation and water screening of the fill recovered 274 small burnt bones and 530 small pieces of debitage. Evidence of in situ burning and the amount of burnt bone indicate the feature was used as a hearth.

Table 45. Micro-debris recovered from the flotation of features at 23JA238.

FEATURE NUMBER	FEATURE TYPE	CULTURAL AFFILIATION	VOLUME (liters)	DEBITAGE	UNWORKED BONE	CARBONIZED NUTSHELLS	CARBONIZED SEEDS	CHARCOAL*	CERAMICS	GASTROPODS	HEMATITE
2	Hearth	Middle Woodland	24.5	530	274	12					48
3	Rock Hearth	Middle Woodland	3.5	15	13			M			
4	Rock Hearth	Middle Woodland	24.6	88	12	50		L			
7	Ash Stain	Middle Woodland	63.5	14		1		M			
8	Refuse Scatter	Middle Woodland	20.0	231	5	26		L			
11	Hearth	Middle Woodland	39.7	474	360			L			
26	Rock Hearth	Middle Woodland	6.0	35		3		L			
27	Hearth	Middle Woodland	6.0	4	2	2		L			
5	Hearth	Late Woodland	65.5	157	113	94		L	1		
6	Hearth	Late Woodland	9.2	64	31	25					
9	Pit	Late Woodland	295.6	190	243	112		M			
10	Hearth	Late Woodland	11.0	36	44	74		L			
13	Daub Scatter	Late Woodland	32.5	26	17		2				
14	Hearth	Late Woodland	2.0	15	11	41		L			
16	Hearth	Late Woodland	102.7	337	930	1075		M	2	2	
32	Pit	Late Woodland	91.0	47	7	51		L			
33	Hearth	Late Woodland	72.0	20	81	20	7	L			
34	Ash Stain	Late Woodland	12.0					L			
1	Hearth	May Brook Phase	9.0	18	1		17	L			
28	Hearth	May Brook Phase	17.0	43	81	30		L		2	
30	Ash Stain	May Brook Phase	31.1	14	5			M			
TOTAL			926.4	2319	2228	1611	26		3	4	48

*L=Light, M=Moderate

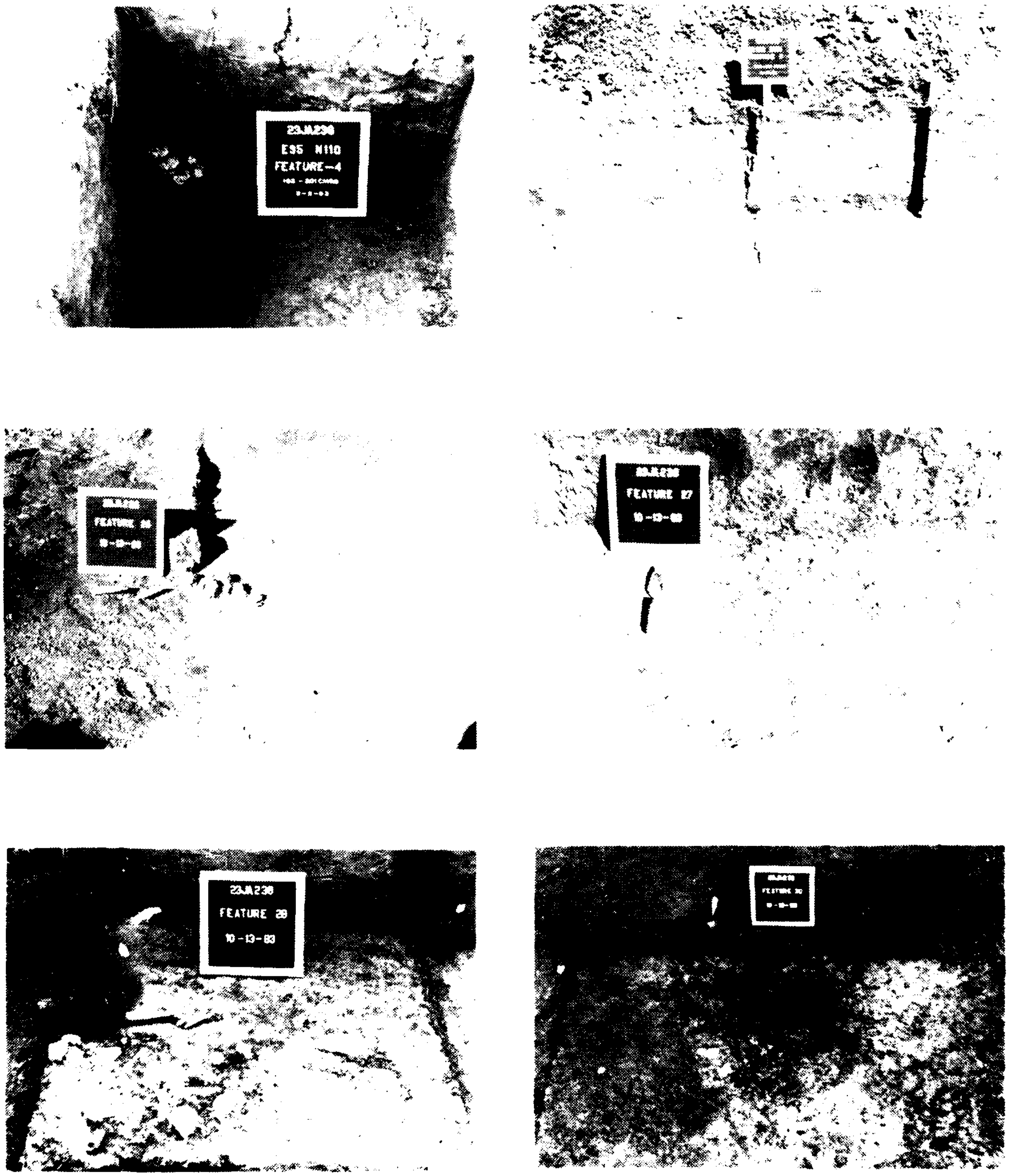


Figure 29. Features recovered from the Middle Woodland and May Brook phase components at 23JA238. a-d, Middle Woodland component; e-f, May Brook phase component.

Feature 3: A small concentration of heated limestone rocks located in a small shallow pit in Block B at a depth of 75-84 cm below surface. The diameter of the concentration and accompanying stain was 25 cm. Small amounts of debitage and bone and a moderate amount of charcoal were recovered from flotation of the feature fill. The proximity of this feature to Feature 2 and the type of deb is present suggest that it functioned as a shallow roasting pit. Limestone cobbles were likely heated in Feature 2 and then transferred to Feature 3.

Feature 4: A small rock hearth located in a small pit in Block B (Figure 29a). The hearth was 30 cm in length by 25 cm in width and was encountered at a depth of 44 cm below surface. It extended to a depth of 55 cm below the surface. The pit was ringed by a faint line of orange burnt clay and contained twelve burnt limestone cobbles. The pit fill was slightly darker in color and lacked the blocky structure of the surrounding soil matrix. Flotation and water screening of the pit fill yielded small quantities of carbonized nutshell fragments, carbonized seeds, burnt bone, debitage, charcoal and flecks of burnt clay. The charcoal and burnt clay indicates in situ burning, suggesting that the feature functioned as a small hearth or shallow earth oven.

Feature 7: A large irregularly shaped ash stain located in Block B. The stain was 225 cm in length and over 114 cm in width. The feature was located at a depth of 60 to 70 cm below the surface and extended into the north wall of Block B (Figure 29b). The feature contained a concentration of charcoal and a large concentration of artifacts including one contracting stemmed Langtry point, one flake scraper, ten pieces of debitage, two unworked bone fragments and one piece of burnt limestone. Flotation and water screening of the feature fill recovered carbonized nutshells, a small amount of debitage and a moderate amount of wood charcoal. Wood charcoal from the feature was dated at 1960±90 years B.P.

Feature 8: A refuse scatter consisting of a concentration of lithic debris intermixed with ashes located in Block B. The feature consisted of a dark organic stain 195 cm in length by 90 cm in width and extended from 43-60 cm below the surface. One contracting stemmed Langtry point, one bifacial knife, one blank, two biface fragments, three utilized flakes, one core fragment, eight burnt limestone rocks, three pieces of unworked bone and 203 pieces of debitage, including 63 flakes, 91 chips, 47 pieces of shatter and two chunks, were recovered. Flotation and water screening yielded a high concentration of small debitage, a few pieces of unworked bone and a number of carbonized nutshells. The high concentration of debitage and broken bifaces suggests that Feature 8 represents lithic reduction debris intermixed with hearth cleaning debris.

Feature 11: Consists of an oval-shaped hearth containing a concentration of burnt clay. The feature was located in Block B and encountered at a depth of 53 to 65 cm below the surface. The feature was 70 cm in length, 42 cm in width and had been partially disturbed by rodent burrowing. Two body sherds, one biface fragment, 17 pieces of debitage, including two flakes, three chips and 12 pieces of shatter, and three pieces of unworked bone were associated with the feature.

Flotation and water screening of the feature fill yielded a large amount of micro-debitage and bone.

Feature 26: A small burnt rock hearth consisting of a cluster of 12 pieces of burnt limestone (Figure 29c). It was encountered at a depth of 55 cm below surface and extended to 60 cm below surface. The feature was approximately 30 cm in length and 25 cm in width. The underlying soil matrix was stained. Four unworked bones and one flake were recovered from the feature. Flotation and water screening produced carbonized nutshells and micro-debitage.

Feature 27: A circular hearth consisting of a concentration of burnt clay located in Block B (Figure 29d). The feature was 48 cm in length and 43 cm in width. It was encountered at a depth of 60 cm below surface and extended to 70 cm below surface. Charcoal flecks and small bone fragments were observed scattered throughout the burnt clay concentration. Flotation and water screening of the feature fill yielded carbonized nutshells and debitage burnt clay.

Late Woodland Component

A total of 18 features, including Features 5, 9, 10, 12/24, 13-22 and 31-34, are associated with the Late Woodland component. Included are three rock hearths, three hearths, a pit, a clay filled basin, a concentration of daub, a charcoal scatter, an ash scatter and seven post molds. The majority of these features are located in Block C and comprise Structure 1. The clay filled basin and a rock hearth (Features 6 and 23) are located in Block D southwest of Structure 1. Two additional hearths (Features 32 and 33) are located east of Structure 1.

Feature 5: Consists of a large burnt rock hearth located in Block C. The feature extended from 19 to 32 cm below the surface. The feature was 160 cm in length by 120 cm in width and contained 99 limestone cobbles thermally oxidized to a pinkish color (Figure 30a). An additional 38 burnt rocks were recovered from the plowzone indicating that the upper portion of Feature 5 had been disturbed by tillage. No distinct soil discoloration or stain was associated with the burnt rock concentration. One side-notched Steuben point, one flake scraper, two flakes, two pieces of an elk mandible and 12 unidentified bone fragments were also recovered. Flotation and water screening of the feature soil matrix yielded a large quantity of debitage, unworked bone and carbonized nutshells. The absence of burnt clay suggests that the limestone cobbles were heated elsewhere. Feature 5 was located just west of a large basin-shaped hearth (Feature 9) which contained a small number of burnt cobbles. It is likely that the stones were heated in Feature 9 and then transferred to Feature 5 which was used as a roasting oven.

Feature 6: A small burnt rock hearth located in Block D. The concentration of burnt limestone was located just north of a dark irregular stain (Figure 30b). The feature was approximately 80 cm in length and 40 cm in width and extended from a depth of 34 to 49 cm below surface. It was located just west of a clay filled basin. The stain

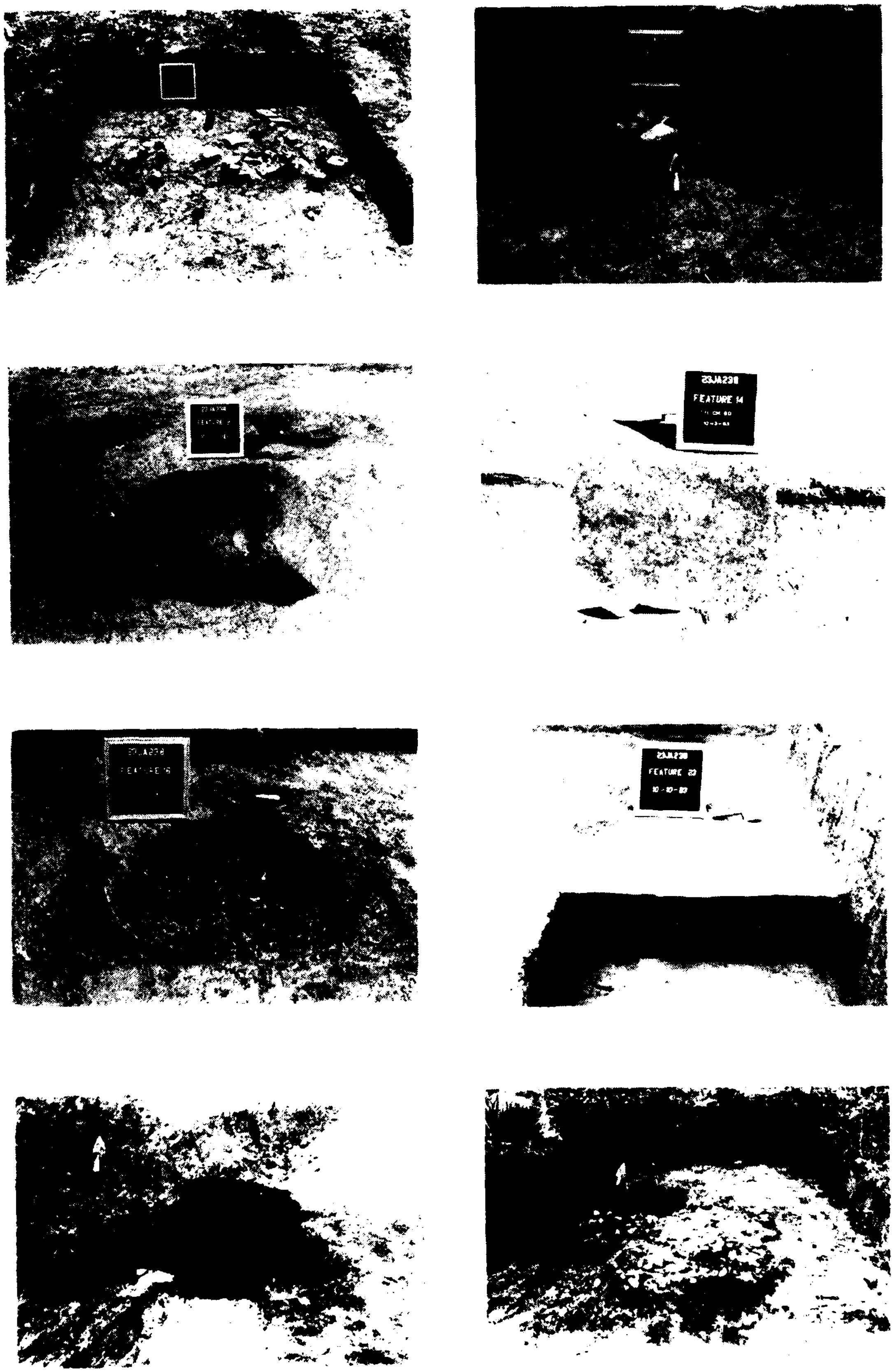


Figure 30. Features recovered from the Late Woodland component at 23JA238.

had a darker color indicative of high organic content and a more granular soil structure than the surrounding lighter colored and more highly structured soil matrix. A small number of burnt clay flecks were present. Associated artifacts include one body sherd, eight pieces of debitage and nine pieces of unworked bone, including a white-tailed deer rib. Flotation and water screening of the feature fill recovered debitage, unworked bone and carbonized nutshell fragments.

Feature 9: A large circular basin-shaped hearth or fire pit located in Block C (Figure 30c). The pit had a diameter of 110 cm and was encountered at a depth of 32 cm below surface and extended to a depth of 77 cm. The feature had a soft granular textured fill which contrasted with the surrounding lighter gray matrix. A rectangular shaped 20 by 30 cm extension on the southeast side of the pit may have functioned as a flue or access to the pit. Burnt clay was present in the feature fill and along the pit edges, although it was not highly concentrated. Artifacts recovered from the pit include several burnt rocks located in the upper few cm of fill on the west edge of the feature. As noted above, this burnt rock is not far from Feature 5 and the burnt rock in that feature was likely heated in Feature 9. Flotation and water screening of the Feature 9 fill yielded a large amount of debitage, bone and carbonized nutshells.

Feature 10: A large circular hearth consisting of an area of burnt clay located in Block C. The hearth was 60 cm in diameter, located at a depth of 30 cm below surface and extended to a depth of 50 cm below surface. Flotation and water screening yielded a moderate amount of carbonized nutshells, burnt bone and debitage. The amount and hardness of the burnt clay concentration is evidence of intensive burning, indicating that Feature 10 was a major hearth in the habitational structure.

Feature 12/24: A small charcoal scatter located in Block C. The stain was 44 cm in diameter and contained a concentration of charcoal in a 9 by 6 cm area. The feature extended from 36 to 40 cm below surface. Wood charcoal from Feature 12/24 has been radiocarbon dated at 1310±60 years B.P.

Feature 13: A concentration of fired daub located in the southwestern corner of Block C just outside Structure 1. The feature was 53 cm in length by 48 cm in width and was located at a depth of 24 cm below surface. It extended to a depth of 39 cm. The excavations recovered concentrations of pole-impressed and grass-impressed daub. One small bone fragment, one unworked stone, three chips, and one piece of shatter were also associated with the feature. Flotation and water screening of the soil surrounding the daub yielded a small amount of debitage and bone and a large amount of burnt clay and daub.

Feature 14: A circular hearth consisting of a concentration of burnt clay containing charcoal flecks and carbonized nutshells located in Block C (Figure 30d). The feature was 67 cm in length by 62 cm in width and extended from 34 to 38 cm below surface. Flotation of the feature fill yielded a small amount of debitage and bone and a moderate number of nutshells.

Feature 15: Consists of a circular stain located in Block C and identified as a post mold. The stain was 30 cm in diameter and was located at a depth of 29 cm below surface. The feature extended to a depth of 42 cm below surface. This stain had a more granular structure than the surrounding blocky soil with a slightly darker inner core approximately 25 cm in diameter. Two small burnt limestone rocks were recovered from the top of the feature at the outer edge of the inner darker stain. Charcoal flecks were present in the feature fill. Feature 15 appears to be a west wall post for Structure 1.

Feature 16: Consists of a basin-shaped pit located in Block C (Figure 30e). The feature consisted of an oval, dark gray stain which extended from a depth of 31 cm below surface to a depth of 56 cm below surface. The pit was 99 cm in length by 77 cm in width. A total of six body sherds, 100 pieces of unworked bone, seven burnt rocks and 22 pieces of debitage including one core fragment, one flake, five chips and five pieces of shatter were recovered from the pit. The unworked bone includes six white-tailed deer bones and a turkey bone. No burnt clay was present in the fill. Flotation and water screening recovered large quantities of debitage, small bones and carbonized nutshells.

Feature 17: A circular stain located in Block C and identified as a post mold. The stain was 30 cm in diameter and extended from 36 to 48 cm below surface. The stain was distinguished from the surrounding lighter colored blocky structured soil matrix by a darker granular textured fill. Cross-sectioning indicated that the stain tapered slightly to a rounded base and contained occasional charcoal flecks. Feature 17 appears to be a south wall post of Structure 1.

Feature 18: A small circular stain located in Block C and identified as a post mold. The stain was 20 cm in diameter and contained a granular fill that extended from 36 to 58 cm below surface. Cross-sectioning indicated that the feature tapered slightly to a rounded bottom. Feature 18 appears to be a west wall post of Structure 1.

Feature 19: Consists of a circular stain 25 cm in diameter located in Block C and identified as a post mold. The stain was encountered at a depth of 33 cm and extended to a depth of 49 cm below the surface. The stain contained charcoal flecks and had a softer more granular structure than the lighter colored blocky surrounding soil matrix. Cross-sectioning indicated that the stain tapered slightly to a rounded bottom. Rodent disturbance was present in the lower portion of the feature. The post mold appears to be a west wall post of Structure 1.

Feature 20: An oval-shaped stain located in Block C and identified as a post mold. The stain was 33 cm in length by 25 cm in width and consisted of a darker fill which was softer and more granular in structure than the surrounding soil. The feature appears to be a north wall post of Structure 1.

Feature 21: A circular stain located in Block C and identified as a post mold. The feature was 30 cm in diameter and consisted of a dark soft granular fill in a lighter colored blocky soil matrix which extended from 46 to 66 cm below the surface. Charcoal flecks were

present in the stain and a faint narrow band of burnt soil outlined the darker stain. Cross-sectioning indicated that the stain tapered to a rounded bottom. The faint band of burnt clay observed in plan view was also present in the profile, indicating that the post may have burned. The feature is a southwest corner post for Structure 1.

Feature 22: A circular stain located in Block C identified as a post mold. The feature was located at a depth of 22 cm and extended to a depth of 37 cm below surface. The stain was 30 cm in diameter and contained a dark soft fill. It had a darker inner core 23 cm in diameter. The feature appears to be a north wall post of Structure 1.

Feature 23: A circular clay-filled basin located in Block D (Figure 30f). This feature was 87 cm in length by 83 cm in width and extended from a depth of 30 cm to 35 cm below the surface. No artifacts were recovered from the feature fill. However, it almost certainly appears to be a cultural feature due to its proximity to Feature 6.

Feature 25: A dark stain located in Block D and identified as a post mold. The stain was located at a depth of 31 cm below the surface and extended 43 cm below the surface. The stain consisted of a dark granular fill. The feature appears to be a north wall support post for Structure 1.

Feature 31: A circular stain encountered in Block C and identified as a post mold. The feature was 25 cm in diameter and extended from a depth of 35 to 43 cm below surface. The feature consisted of a dark soft fill in a lighter soil matrix. It appears to be an east wall post for Structure 1.

Feature 32: A basin-shaped hearth or fire pit located in Scraper Cut 1 (Figure 30g). The feature was oval to slightly irregular in plan view and extended from a depth of 27 to 57 cm below the surface. It had a maximum length of 77 cm and a width of 51 cm. A total of 54 burnt rocks were recovered from either the feature fill or in close proximity to the feature. Flotation recovered a moderate amount of debitage and carbonized nutshells.

Feature 33: A burnt rock hearth located in Scraper Cut 1 (Figure 30h). The feature had a length of 165 cm, a width of 105 cm and extended from a depth of 23 cm to 33 cm below surface. One straight stemmed projectile point, 227 pieces of burnt limestone cobbles and six unworked bones were recovered from the feature. Flotation produced 20 pieces of debitage, 81 small unworked bones, 20 carbonized nutshells and seven carbonized seeds.

Feature 34: A small basin-shaped ash stain located in Scraper Cut 2. The stain was located at a depth of 26 cm below surface and extended to a depth of 61 cm below the surface. The stain had a length of 41 cm and a width of 31 cm and a fill consisting of a heavy concentration of charcoal.

May Brook Phase Component

Four features including Features 1, 28, 29 and 30 were located in Block A and are associated with the May Brook phase component at the site.

Feature 1: A burnt rock hearth located in the 1979 Test Unit 1 which was incorporated into Block A in 1983. The feature consisted of ten thermally oxidized limestone cobbles located at a depth of 85-90 cm below ground surface. A small sample of charcoal was associated with the cobbles. Flotation and water screening of the feature fill recovered a small sample of debitage and a number of carbonized seeds.

Feature 28: A cluster of burnt rock located in Block A (Figure 29f). The feature extended from 95 to 100 cm below surface and consisted of 11 burnt rocks in an area 85 cm in length by 70 cm in width. No discernable stain was associated with the burnt rock scatter, however, flecks of charcoal and burnt clay were present in the underlying soil matrix. One white-tailed deer bone was associated with the feature. Flotation and water screening of the feature matrix yielded small quantities of debitage, bone and carbonized nutshells.

Feature 29: A concentration of charcoal and burnt clay located in Block A. The feature was located at a depth of 111 to 115 cm below surface and extended over an area 40 cm in length by 35 cm in width. No artifacts were recovered in association with the feature. Part of the charcoal from the feature consists of a piece of carbonized wood 6 cm in diameter.

Feature 30: Consists of a large concentrated deposit of charcoal located in Block A (Figure 29e). The charcoal was scattered over an area 120 cm in length by 55 cm in width and extended from a depth of 123 to 131 cm below surface. No artifacts were associated with the feature, although flotation and water screening of the feature fill yielded a large quantity of wood charcoal and a few pieces of debitage and bone.

CERAMICS

A total of ten rim sherds and 235 body sherds were recovered from 23JA238. Included are two rims and 12 body sherds from Block A, 63 body sherds from Block B, eight rims and 126 body sherds from Block C, two body sherds from Block D, 30 body sherds from the test units and two body sherds from the cutbank of the Little Blue River. The ten rims include seven associated with the Late Woodland component, two with the May Brook phase component and one which was recovered from the upper deposits in Block C, but which could be associated with the Middle Woodland component.

Rim Sherds (n=10)

Eight of the ten rims were recovered from Block C (Table 46). Based on rim form, surface finish, temper and thickness, seven of these

Table 46. Descriptive data for rim sherds from 23JA238.

CATALOG NUMBER	COMPONENT*	PROVENIENCE	DATUM DEPTH (m)	SUFACE TREATMENT EXTERIOR	INTERIOR	TEMPER	LIP FORM	MUNSELL COLOR	DIMENSIONS (mm) Rim Height	Rim Thickness	Lip Thickness
BLOCK A											
79	MBP	E100,N99	2.59	Cordmarked	Smoothed	Sherd	Rounded	10YR6/3	25	6	5
95	MBP	E100,N100	2.81	Cordmarked	Smoothed	Sherd	Rounded	10YR6/3	24	6	4
BLOCK C											
1358	MW or LW	E86,N128	1.65	Incised	Smoothed	Sand/ Grit	Tool Impressed	10YR3/2	-	10	6
1378	LW	E87,N109	1.75	Smoothed	Smoothed	Sand/ Grit	Rounded	10YR7/6	22	4	4
1455	LW	E88, N122	1.60	Smoothed	Smoothed	Sand/ Grit	Tool Impressed	10YR7/6		7	5
1474	LW	E89,N119	1.59	Smoothed	Smoothed	Sand/ Grit	Rounded	10YR7/6	17	5	5
1553	LW	E90,N119	1.58	Smoothed	Smoothed	Sand/ Grit	Rounded	10YR7/6	15	5	5
1634	LW	E91,N121	1.61	Smoothed	Smoothed	Sand/ Grit	Rounded	10YR7/6	15	5	4
1640	LW	E91,N122	1.71	-	Smoothed	Sand/ Grit	Tool Impressed	10YR7/6	-	-	7
TEST UNITS											
2003	LW	E108,N103	2.03	Smoothed	Smoothed	Sand/ Grit	Rounded	10YR7/6	15		4

*MW=Middle Woodland, LW=Late Woodland, MB=May Brook Phase

appear to be sections of Late Woodland vessels and one appears to be from a vessel with earlier Middle Woodland characteristics. The Late Woodland rims from Block C include five sections from plain surfaced undecorated jars characterized by constricted orifices and slightly outflaring rim profiles (Figure 31a-d). The interior and exterior surfaces are smoothed and the lips are rounded. The rim height of these five sherds ranges from 15 to 22 mm and the orifice diameter from 29 to 30 cm. Rim thickness varies from 4 to 5 mm and lip thickness from 4 to 5 mm. Interior and exterior surface colors range from pale brown (10YR4/2) to brownish yellow (10YR7/6). The core color is predominately dark gray (10YR4/1). All are tempered with abundant grit or sand grains consisting of angular and subangular mica, quartzite and feldspar generally less than 2 mm in size.

The two remaining Late Woodland rims are small sections of vessels with crenated lips (Figure 31e-f). The lip thickness of these two rims ranges from 5-7 mm. The interior surface of both are smoothed. The crenated lips were formed by obliquely oriented dowel or finger impressions spaced 7-10 mm apart. These impressions are 4-5 mm in depth and 7-9 mm in length. The color and temper of both conform to that for the other rim sherds.

The eighth rim from Block C is a small section of a vessel with exterior decoration consisting of obliquely oriented incised lines just below the lip. These incisions could have been formed by rocker stamping (Figure 31g). The lip is also decorated on the interior by obliquely oriented cord wrapped stick impressions. The rim thickness is 10 mm and the lip thickness is 6 mm. Both the interior and exterior surfaces are very dark grayish brown (10YR3/2) while the core color is very dark gray (10YR3/1). The sherd is tempered with angular pieces of grit consisting of mica, feldspar and quartzite ranging in size from 1 to 3 mm. The cord wrapped stick impressions and possible rocker stamping suggest a Middle Woodland Hopewell cultural affiliation. Chapman (1980:38-39) has noted that cord wrapped stick decoration is characteristic of the Middle Woodland Hopewellian Lamine phase in central Missouri. The rim was recovered from a depth of 27 cm outside the Late Woodland Structure 1 just north of Features 9, 10 and 14. However, the sherd could be associated with the earlier Middle Woodland occupation at the site and was only incorporated into the Late Woodland deposits when the pits in Structure 1 were excavated, since they extend down into the Middle Woodland deposits.

The two rims from the May Brook phase component are from Block A. Both have vertically oriented smoothed-over cordmarking on the exterior surface and smoothed interior surfaces (Figure 31h-i). Both have straight rims and slightly flattened lips and are sufficiently similar to have been from the same vessel. Both are sherd tempered. Rim height is a consistent 25 mm, rim thickness ranges from 5-6 mm and lip thickness is 4-5 mm. Interior surface color is a light yellowish-brown (10YR6/3), exterior color is brown (10YR5/3) and core color is dark gray (10YR4/1). The orifice diameter of the vessel or vessels would have been about 15 cm. Both sherds compare favorably with ceramics recovered from other May Brook phase components in the Little Blue valley (Brown 1981; Schmits 1982b).

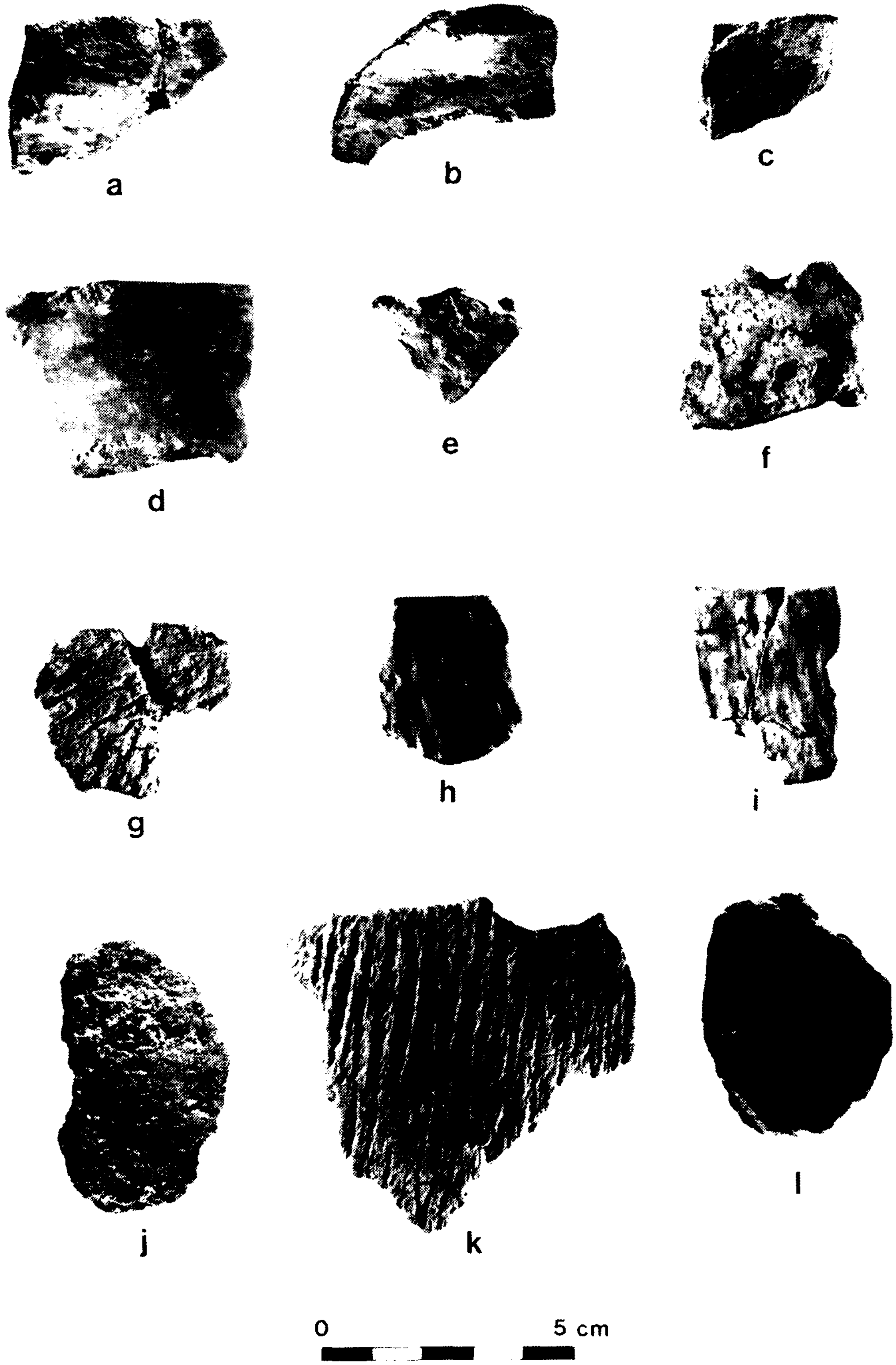


Figure 31. Ceramics from 23JA238: a-d, plain Late Woodland rims; e-f, crenated Late Woodland rims; g, decorated Middle Woodland rim; h-i, smoothed-over cordmarked May Brook phase rims; j, plain Middle Woodland body sherd; k, cordmarked May Brook phase body sherd; l, smoothed-over cordmarked May Brook body sherd.

Body Sherds (n=235)

Half of the 235 body sherds recovered from 23JA238 are too small or too badly eroded for analysis. The sample sufficiently large for study includes 17 from the Middle Woodland component, 76 from the Late Woodland component, 13 from the May Brook phase component and 12 sherds which cannot be assigned to any of these three components with certainty (Table 47).

The 17 body sherds from the Middle Woodland component range from 15-68 mm in maximum dimension. All were recovered from depths ranging from 48 to 65 cm below surface so their association with the Middle Woodland component seems quite probable. Nine have smoothed exterior surfaces (Figure 31j) and eight have smoothed-over cordmarked exterior surfaces. All interior surfaces are smoothed. All 17 are tempered with abundant grains of large angular grit ranging from 1 to 4 mm in diameter. Interior and exterior surfaces range from dark gray (10YR3/2) to reddish-yellow (7.5YR6/6). The core color is generally

Table 47. Summary of descriptive data for body sherds from 23JA238.

	MIDDLE WOODLAND	LATE WOODLAND	MAYBROOK PHASE	UNASSIGNED
TEMPER				
Bone		1		
Sherd			10	4
Indurated Clay		1		1
Sherd and Hematite			2	
Coarse Grit	17			1
Sand or Fine Grit		73		6
Sand and Shell			1	
Sandstone		1		
Total	17	76	13	12
EXTERIOR SURFACE TREATMENT				
Cordmarked			11	3
Smoothed	9	75		7
Smoothed-Over Cordmarked	8	1	2	1
Smoothed and Cordmarked				1
Total	17	76	13	12
THICKNESS (mm)				
Minimum	7	4	5	5
Maximum	15	9	9	11
Mean	9.47	6.22	6.59	6.75
Standard Deviation	1.98	1.11	1.28	2.30

very dark gray (10YR3/1). The thickness of the sherds ranges from 7 to 15 mm with an average of 9.5 mm. Two sherds have decorations consisting of incised lines on plain exterior surfaces and three were apparently slipped on the exterior during the finishing process.

The 76 body sherds recovered from the Late Woodland component were all recovered from the upper 40 cm and range from 14 to 81 mm in maximum dimension. All but one of these body sherds are smoothed on both interior and exterior surfaces. The exception is a sherd that exhibits smoothed-over cordmarking on its exterior surface and a smoothed interior surface. Nearly all the sherds are tempered with a fine angular grit or sand that is generally less than 2 mm in diameter. One specimen has bone temper, one has indurated clay or crushed sherd temper and one has crushed sandstone temper. Interior surface color ranges from very dark gray (10YR3/1) to light yellowish-brown (10YR6/4) and exterior color from dark grayish-brown (10YR4/[illegible]) to yellowish-red (5YR5/8). Core color is generally dark gray (10YR3/2). The sherds range in thickness from 4 to 9 mm with an average of 6.2 mm. Surface decoration is absent.

The 13 body sherds recovered from the May Brook phase component range from 19 to 73 mm in maximum dimension. Eight were recovered from 70 to 130 cm below surface in Block A and five were recovered from 60-80 cm below surface in the three test units located just northeast of Block A. All of the May Brook phase sherds are cordmarked on the exterior surface and smoothed on the interior surface (Figure 31k). Two sherds have smoothed-over cordmarking (Figure 31l). The May Brook phase body sherds are predominately tempered with crushed sherd, although two are sherd and hematite tempered and one is sand and shell tempered. Interior surface color ranges from very dark grayish-brown (10YR3/2) to pale brown (10YR4/3) and the exterior color from brown (10YR4/3) to very pale brown (10YR7/4). The core color is predominately dark gray (10YR3/2). Individual sherd thickness ranges from 5 to 9 mm with an average of 6.6 mm. Decoration other than cordmarking is absent.

The 12 unassigned sherds from the mixed or unknown deposits at 23JA238 exhibit characteristics of the ceramics from all three components. Two sherds closely resemble the other Middle Woodland ceramics with smooth or smoothed-over cordmarked exterior surfaces, grit temper and thicknesses ranging from 10 to 11 mm. One was recovered at a depth of 41 cm from one of the test units northeast of Block A. The other was recovered from a depth of 27 cm in Block D. Five of the unassigned sherds are sand or grit tempered, have smooth surfaces and a thickness ranging from 5 to 8 mm. These sherds are probably associated with the Late Woodland component. One was recovered from 52 cm below surface within Block B, four were recovered from 40-60 cm below the surface in Test Units E105,N105 and E108,N103 and one was recovered at 131 cm below the surface within the cutbank of the Little Blue River.

Although the ceramics recovered from the Middle Woodland, Late Woodland and May Brook phase components are relatively small, several striking differences are evident between the assemblages from the three components. The Middle Woodland ceramics are grit tempered, plain or smoothed-over cordmarked vessels with thick walls that are tempered with

coarse grains of grit. The Late Woodland ceramics are generally thin walled vessels with fine sand or grit temper and smoothed surfaces that lack decoration. Rims on these vessels are gently outsloping and in some cases are crenated. The orifice diameter of the rims cluster at about 30 cm indicating the presence of fairly large jars. The May Brook phase ceramics consist of thin, sherd tempered cordmarked vessels with straight rims.

LITHIC ASSEMBLAGE

The lithic assemblage recovered from 23JA238 includes 297 chipped stone tools, 3871 pieces of lithic manufacturing debris, two ground stone tools, 11 minerals and 773 unworked stones. The distribution of this material by component is shown in Table 48.

Chipped Stone Tools

A total of 297 chipped stone tools were recovered from 23JA238. Of this number, 171 can be assigned to the Middle Woodland component, 84 to the Late Woodland occupation and 33 to the May Brook phase component. Nine tools are either from disturbed contexts or from test units which cannot be clearly assigned to one of the three components. The materials recovered from the 1979 test excavations conducted by Soil Systems, Inc. were obtained on loan from the University of Kansas Museum of Anthropology. Three bifacial scrapers, eight unifacial scrapers, one notch and 44 edge-modified flakes were not present in the collection and appear to have been either misplaced or lost while at the university. Descriptive data from Schmits and Reust (1982b) has been included for these tools.

The chipped stone tool assemblage includes 78 bifaces including 21 projectile points, one drill, nine bifacial knives, 14 bifacial blanks, ten bifacial scrapers and 23 biface fragments. Unifacial, marginally retouched and edge-modified tools include 18 unifacial scrapers, one notch, 11 flake scrapers, one perforator, four edge-modified cores, 178 edge-modified flakes and six edge-modified chunks.

The assemblage primarily consists of blue gray Winterset chert with 82.5 percent of the tools being manufactured from this material. The remaining 17.5 percent of the tools are either other Kansas City Group cherts, such as tan Winterset, Westerville, and Argentine (n=10), or are non-local white cherts (n=9) from Mississippian System formations to the east.

Projectile Points (n=21)

A total of 21 projectile points including four small arrow points and 17 larger dart points were recovered from 23JA238 (Table 49). The four arrow points are from the May Brook phase deposits in Block A. Included are three notched specimens made from unheated Winterset chert (Figure 32a-c) and one unnotched form made from a non-local white

Table 48. Lithic assemblage from 23JA238.

	MIDDLE WOODLAND	LATE WOODLAND	MAY BROOK PHASE	UNASSIGNED	TOTAL
CHIPPED STONE TOOLS					
Projectile Points	9	6	4	2	21
Drill		1			1
Bifacial Knives	4	3	2		9
Bifacial Blanks	10	3	1		14
Bifacial Scrapers	5	3	2		10
Biface Fragments	16	4	3		23
Unifacial Scrapers	11	7			18
Notch	1				1
Flake Scrapers	3	4	4		11
Perforator	1				1
Edge-Modified Cores	3	1			4
Edge-Modified Flakes	107	47	17	7	178
Edge-Modified Chunks	1	5			6
Total	171	84	33	9	297
GROUND STONE TOOLS					
Metate	1				1
Fragments	1				1
Total	2				2
LITHIC MANUFACTURING DEBRIS					
Flakes	872	237	48	84	1241
Chunks	29	5	10		44
Shatter	627	244	19	32	919
Chips	1330	227	45	40	1642
Cores	8	13	2	2	25
Total	2866	723	124	158	3871
MINERALS					
Hematite	7	1		1	9
Ocher		2			2
Total	7	3		1	11
UNWORKED STONE	82	661	27	3	773
TOTAL	3128	1471	184	171	4954

Table 49. Descriptive data for projectile points from 23JA238.

CATALOG NUMBER	COMPONENT*	PROVENIENCE	DATUM DEPTH (m)	POINT TYPE	CHERT TYPE**	USE-WEAR ***	WT. (g)	DIMENSIONS (mm) Lgth	Wdth	Stem Wdth	Base Wdth	Stem Lgth	Notch Wdth	Notch Depth	Thick -ness
BLOCK A															
129	MP	E103,N100	2.57	Arrow	NLW		0.7	-	14	-	-	-	-	-	3
141	UNK	E101,N100	1.90	Lanceolate	WN	GC	13.9	60	13	-	22	-	-	-	10
191	MP	E102,N100	2.14	Arrow	WN		0.5	-	11	6	-	-	-	-	3
241	MP	E103,N100	2.59	Arrow	WN		0.8	-	12	-	-	-	-	-	4
651	MP	E104,N100	2.48	Huffaker	WN	IF	0.6	19	14	-	-	6	2	1	3
BLOCK B															
55	MW	E87,N110	1.95	Langtry	WN	GC, IF	14.9	72	35	20	-	18	20	8	7
412	MW	E88,N110	1.96	Langtry	AR	GC, IF	12.4	-	34	22	17	17	19	6	8
896	LW	E93,N110	1.49	Steuben	NLW+		8.8	49	24	21	24	16	9	2	7
932	MW	E94,N110	1.87	Manker	NLW+		14.9	52	36	25	29	18	13	6	9
933	MW	Feature 8	1.94	Langtry	WN	GC	10.3	54	32	19	18	15	13	7	8
1183	MW	Feature 7	2.17	Langtry	WN	GC	16.8	-	43	24	17	22	27	10	9
BLOCK C															
1325	LW	Feature 5	1.69	Steuben	NLW+	GC, IF	10.1	39	27	25	31	16	13	1	8
1421	LW	E88,N118	1.69	Steuben	WN	LDS	13.7	58	24	21	24	16	14	2	10
1422	LW	E88,N118	1.70	Steuben	WN	GI	9.8	55	25	21	-	12	11	2	8
TEST UNITS															
119	MW	E100,N109	1.85	Langtry	AR?	GC	6.4	52	25	19	16	15	15	3	7
1790	LW	E95,N105	1.69	Steuben	WN	IF	17.7	66	26	21	27	18	15	3	11
1799	MW	E95,N105	2.00	Langtry	WN	GC	12.8	-	30	17	-	-	-	7	8

continued

Table 49 continued. Descriptive data for projectile points from 23JA238.

CATALOG NUMBER	COMPONENT*	PROVENIENCE	DATUM DEPTH (m)	POINT TYPE	CHERT TYPE**	USE-WEAR ***	WT. (g)	DIMENSIONS (mm) Lgth	Wdth	Stem Wdth	Base Wdth	Stem Lgth	Notch Wdth	Notch Depth	Thick-ness
2040	MW	E95,N115	1.84	Marshall	WN	GC	13.8	-	40	22	-	-	10	9	10
2041	MW	E95,N115	2.01	Corner-notched	WN	GC	31.6	-	-	-	-	-	-	-	10
CUT BANK															
19	UNK	Cutbank	Surface	Corner-notched	WN	GC, GI	17.8	87	29	11	22	16	11	9	8
SCRAPER CUT															
2059	LW	Feature 33		Stemmed	WN	HDC	7.3	-	28	22	22	12	11	3	9

*MP=May Brook Phase, MW=Middle Woodland, LW=Late Woodland, UNK=Unknown
** WN=Winterset, AR=Argentine, NLW=Non-Local White, +=Heated
***GC=General Cutting, IF=Impact Fracture, LDS=Light-Duty Scraping, HDC=Heavy-Duty Cutting, GI=Graving/Incising

Mississippian System chert (Figure 32d). The notched points include two distal sections of side-notched points that have fractured transversely across the notch. These would appear to be segments of one of the several notched arrow point types such as Reed Side Notched, Huffaker Notched or Cahokia Notched described by Chapman (1980). The third notched point is a double side-notched and basally notched arrow point comparable to the Huffaker Notched type. It has a distal impact fracture and a transverse basal fracture (Figure 32c). The unnotched arrow point is a triangular specimen comparable to Mississippi Triangular (Chapman 1980). It is made from non-local white chert.

The 17 larger dart points include nine from the Middle Woodland component, six from the Late Woodland component and two which are from either disturbed contexts or cannot definitely be assigned to either the Late Woodland or Middle Woodland components. Included are six contracting stemmed, one straight stemmed, four corner-notched, five side-notched and one lanceolate point. Six of the points from the Middle Woodland component are contracting stemmed forms (Figure 32e-j) similar to the Langtry type (Chapman 1980). These points are characterized by a triangular plan form and a lenticular cross-section. The contracting stems generally have concave bases although three have basal fractures and the full basal morphology is not readily apparent. Two of the Langtry points have impact fractures and one has a transverse blade fracture. The blades of the Langtry points range from excurvate to straight to incurvate. Much of this variability in blade form appears to result from successive episodes of resharpening. This resharpening consists of unidirectional retouch producing alternately beveled blade margins. Repeated episodes of resharpening have resulted in narrow blades with steep planoclinal edges on some specimens (Figure 32i-j).

The straight stemmed point recovered from the scraper cut is a small triangular form with a straight or slightly contracting stem made from unheated Winterset chert (Figure 32k). This point is associated with the Late Woodland component.

The four corner-notched points include three from the Middle Woodland component and one with an unknown association recovered from the river bank. Two of the Middle Woodland corner-notched points are medium-sized triangular points (Figure 32l-m). One of these is made from heated non-local white chert and clearly resembles the Mankers type (Figure 32l). The second is made from unheated Winterset chert and resembles the the Marshall Barbed type (Figure 32m). The third is a large subtriangular point made from unheated Winterset chert with a diagonal proximal fracture (Figure 32n). The point may have been a Snyders point although the barb on this point more closely resembles that found on many basally-notched Archaic points. All three of these types, Mankers, Marshall Barbed and Snyders, are common Middle Woodland forms in the Lower Illinois valley (White 1968). The corner-notched point recovered from the cutbank is a long narrow form with deep corner notches (Figure 32o). The haft element is asymmetrically oriented to the blade and the point likely served as a hafted cutting tool. This point is similar to the Cupp type described by Chapman (1980).

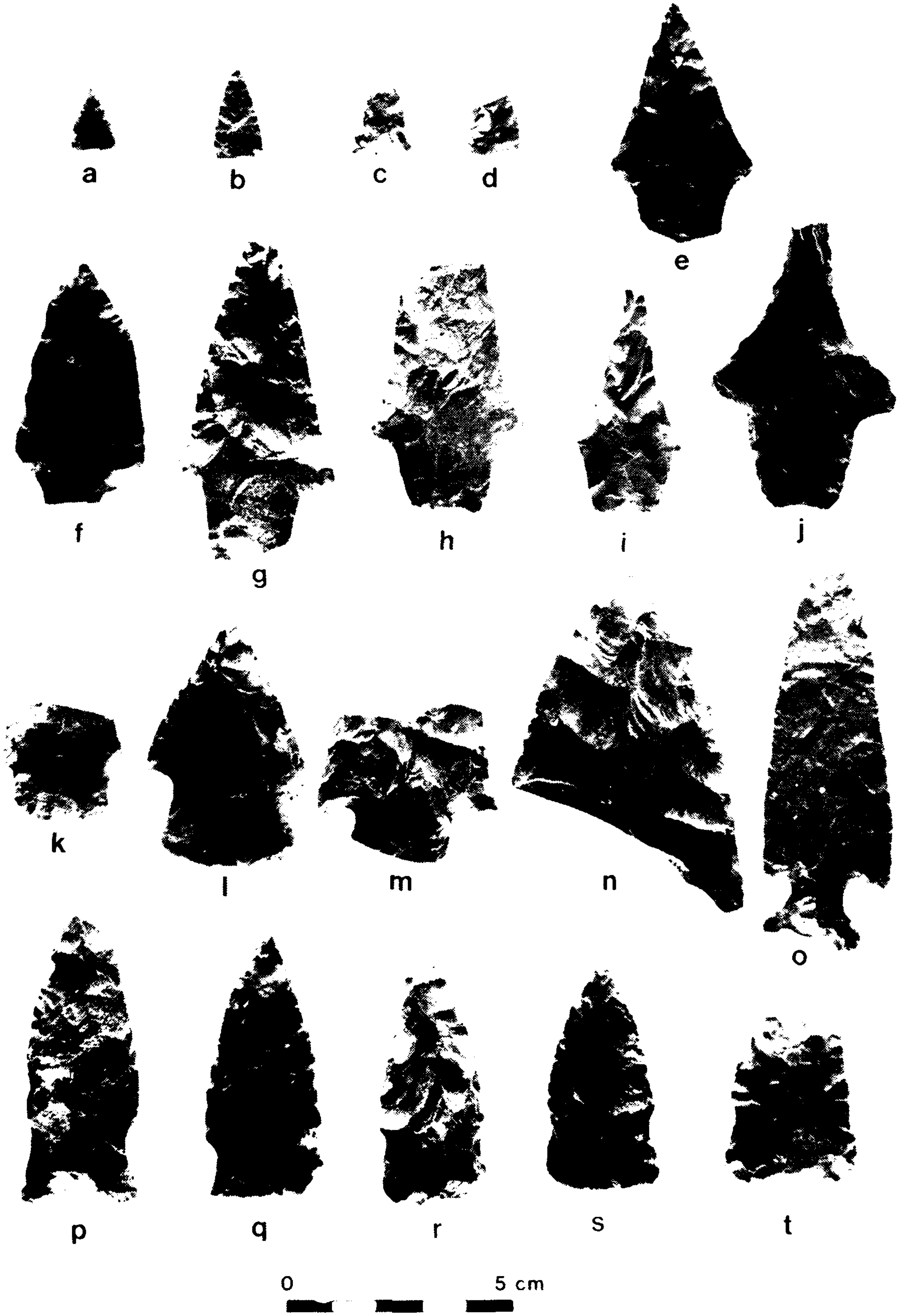


Figure 32. Projectile points from 23JA238: a-d, arrow points from the May Brook phase component; e-j, Langtry points from the Middle Woodland component; k, Late Woodland straight stemmed point; l-n, Middle Woodland corner-notched points, o, unknown corner-notched point; p-t, Late Woodland Steuben points.

Five side-notched points recovered from the site are medium-sized subtriangular forms with lenticular cross-sections which are comparable to the Steuben type (White 1963, Chapman 1980). All five are associated with the Late Woodland component (Figure 32p-t). Three are made from unheated Winterset chert and two are made from heated non-local chert.

The lanceolate point is a Nebo Hill point made from unheated Winterset chert. The point was recovered from the upper Unit A deposits above the May Brook phase component in Block A along with other historic artifacts and is clearly out of context.

Eight of the nine Middle Woodland points exhibit abrasive use-wear indicating general cutting activities. Two of these also are impact fractured indicating use as projectiles. Three of the four Late Woodland points exhibit use-wear and two have impact fractures. One exhibits general cutting wear, one has heavy-duty cutting wear, another has wear indicative of graving/incising and one has pronounced light-duty scraping wear along the entire basal margin. The May Brook phase arrow points exhibit no abrasive use-wear. Only one has an impact fracture.

Drill (n=1)

The distal bit of a drill made from Westerville chert was recovered from the Late Woodland component (Figure 33a). Sporadic polish indicating boring or piercing use is present along its resharpened edges.

Bifacial Knives (n=9)

A total of nine bifacial knives were recovered (Table 50). All are thin bifaces with lenticular cross-sections and straight edges which exhibit moderate to pronounced abrasional wear. Included are two with lanceolate, four with subtriangular, two with ovate and one with subrectangular plan forms. Four are complete and five are fragments with either transverse or diagonal fractures.

Four knives are from the Middle Woodland component. All are Winterset chert and only one has been heated. Three are medium-sized subtriangular specimens which appear to be Langtry preforms that were subsequently used as knives (Figure 33b-d). The fourth is an incomplete large ovate specimen which appears to have been broken during final thinning stages (Figure 33e).

The three bifacial knives recovered from the Late Woodland component are all incomplete and made from unheated Winterset chert. One is a large thin, subrectangular specimen with a transverse fracture (Figure 33f). The other two ovate specimens fractured during secondary thinning (Figure 33g-h).

The two bifacial knives recovered from the May Brook phase component are complete and have lanceolate plan forms. One is a large Winterset biface which exhibits only primary thinning with marginal retouch along both edges (Figure 33i). The other is a thin, slightly asymmetrical biface with an unfinished base made from Westerville chert (Figure 33j).

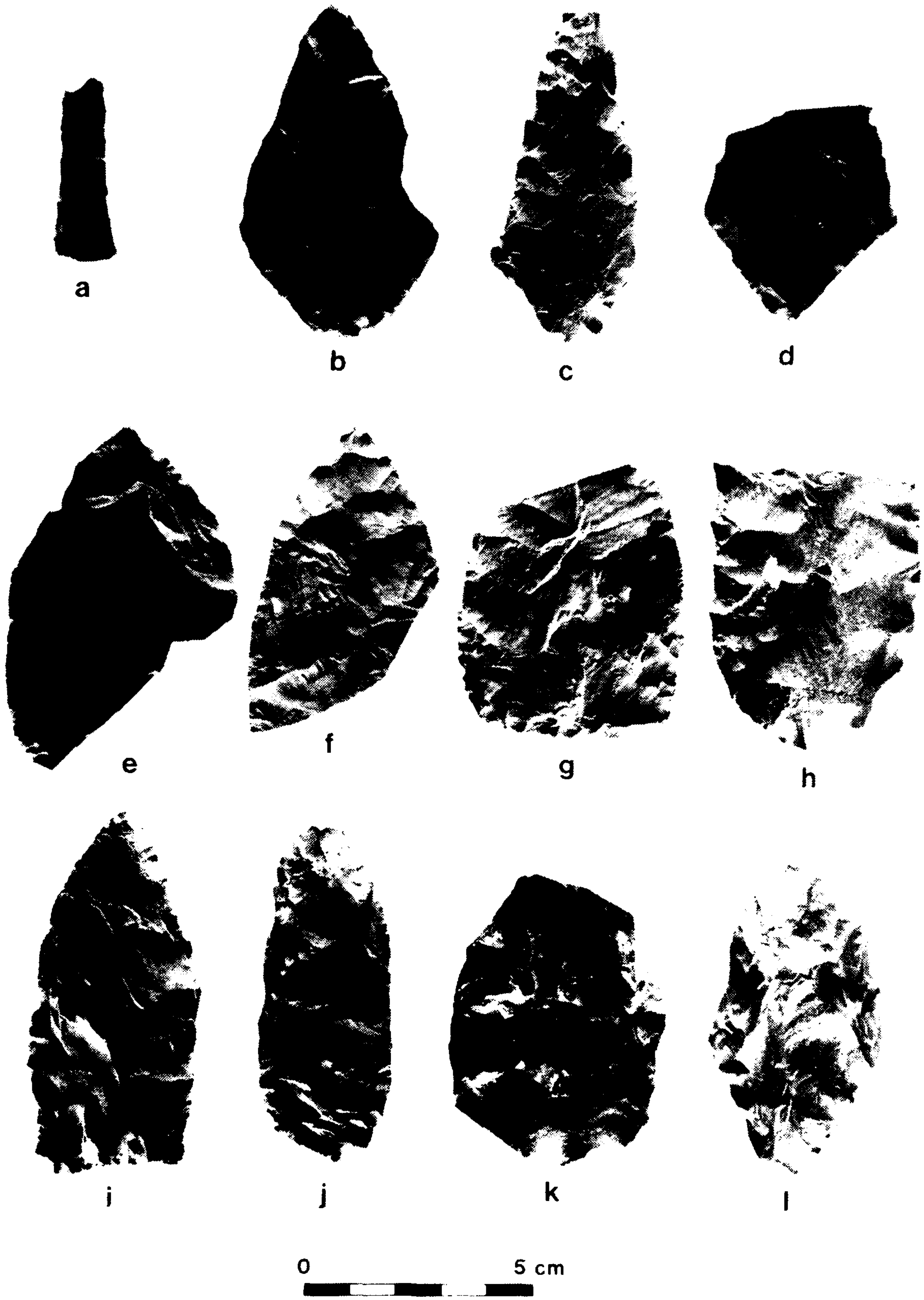


Figure 33. Bifacial tools from 23JA238: a, Late Woodland drill; b-e, Middle Woodland bifacial knives; f-h, Late Woodland bifacial knives; i-j, May Brook phase bifacial knives; k-l, bifacial blanks.

Table 50. Descriptive data for bifacial tools from 23JA238.

CATALOG NUMBER	COMPONENT*	PROVENIENCE	TOOL TYPE	DATUM DEPTH (m)	CHERT TYPE**	WEIGHT (g)	DIMENSIONS (mm) LENGTH	WIDTH	THICKNESS	USE-WEAR ***
BLOCK A										
113	MP	E100,N100	Knife	2.98	TWN	31.9	78	38	12	HDC
157	MP	E101,N100	Knife	2.65	WS	17.8	78	30	8	GC
110	MP	E101,N99	Blank	2.63	WN	72.8	75	53	19	GS
104	MP	E100,N100	Scraper	2.79	WS	58.4	95	40	15	HDS
341	MP	E100,N103	Scraper	2.53	WN	50.2	60	51	21	LDS
92	MP	E100,N100	Fragment	2.55	WN+	2.9	28	18	6	-
134	MP	E100,N100	Fragment	2.87	WN+	58.8	-	-	25	-
156	MP	E101,N100	Fragment	2.65	WN	38.4	65	41	24	GC
BLOCK B										
292	MW	E86,N109	Knife	2.06	WN	24.0	72	43	10	HDC
977	MW	Feature 8	Knife	1.94	WN	36.0	-	50	12	GI
1032	MW	E95,N110	Knife	1.87	WN	13.7	-	43	9	GC
268	MW	E86,N109	Blank	1.99	WN	22.2	41	34	21	HDC
409	MW	E88,N110	Blank	2.00	WN	68.3	-	57	25	GS
721	MW	E88,N111	Blank	1.95	NLW	20.4	45	37	15	HDC,LDC
813	LW	E90,N111	Blank	1.55	WN	41.8	65	41	19	GS
824	MW	E90,N111	Blank	1.90	WN	16.8	53	37	13	HDS
855	MW	E91,N110	Blank	2.04	WN	35.3	70	41	18	GS
860	MW	E91,N110	Blank	2.14	WN	50.8	88	41	18	-
934	MW	Feature 8	Blank	1.94	WN	50.1	55	46	17	GS
1008	MW	E95,N109	Blank	1.90	WN	23.2	46	31	17	GC
56	MW	E87,N110	Scraper	1.99	WN+	17.7	50	37	9	X
57	MW	E87,N110	Scraper	1.99	WN	32.8	53	50	13	X
318	MW	E87,N110	Scraper	1.97	WN	17.7	45	44	11	X
826	MW	E90,N111	Scraper	1.92	WS	16.9	41	36	16	HDS
273	MW	E86,N109	Fragment	1.98	WN	9.9	-	-	7	GC
427	MW	E88,N110	Fragment	2.12	WN	7.1	40	-	8	LDS

continued

Table 50 continued. Descriptive data for bifacial tools from 23JA238.

CATALOG NUMBER	COMPON-NENT*	PROVENIENCE	TOOL TYPE	DATUM DEPTH (m)	CHERT TYPE**	WEIGHT (g)	DIMENSIONS (mm) LENGTH	WIDTH	THICKNESS	USE-WEAR ***
689	MW	E87,N111	Fragment	1.94	WN	16.3	-	-	15	HDS
712	MW	E88,N111	Fragment	1.85	WN	4.6	-	-	9	GC
875	MW	E91,N111	Fragment	2.05	WN	7.5	-	-	9	GC
884	MW	E92,N110	Fragment	1.86	NLW+	24.0	-	-	14	-
940	MW	Feature 8	Fragment	2.02	WN	2.5	-	-	9	-
976	MW	Feature 8	Fragment	1.94	WN	1.8	-	-	7	GS
1107	MW	E96,N109	Fragment	1.90	WN	7.5	-	-	9	GS
1120	MW	E96,N109	Fragment	1.99	WN	1.4	-	-	5	-
1139	MW	E96,N110	Fragment	1.86	WN	27.9	-	-	18	-
1156	MW	E96,N111	Fragment	1.80	WN	0.4	-	-	4	-
1172	MW	Feature 11	Fragment	3.03	WN	3.5	-	-	11	-
1173	MW	E96,N111	Fragment	2.01	WN	0.8	-	-	5	GC
BLOCK C										
1243	LW	E85,N118	Drill	1.53	WS	4.1	42	16	7	BP
1366	LW	E87,N118	Knife	1.62	WN	27.9	-	48	7	GC
1398	LW	E87,N121	Knife	1.72	WN	39.9	-	51	13	GC
1359	LW	E86,N123	Blank	1.67	WN	83.2	69	48	35	LDS
1429	LW	E88,N119	Scraper	1.78	WN	28.5	47	37	20	-
1456	LW	E88,N122	Scraper	1.66	WN	46.6	60	40	22	GS
BLOCK D										
1697	LW	E76,N114	Scraper	1.48	WN	12.4	-	38	8	GS
1728	LW	E77,N115	Fragment	1.60	WN	6.3	-	-	11	-
TEST UNITS										
1774	MW	E90,N105	Knife	2.01	WN+	20.9	76	33	11	GC
1897	LW	E105,N110	Knife	1.85	WN	26.9	-	-	12	GC
1818	MW	E95,N115	Blank	1.85	WN	66.1	-	62	24	GS

continued

Table 50 continued. Descriptive data for bifacial tools from 23JA238.

CATALOG NUMBER	COMPONENT*	PROVENIENCE	TOOL TYPE	DATUM DEPTH (m)	CHERT TYPE**	WEIGHT (g)	DIMENSIONS (mm) LENGTH	WIDTH	THICKNESS	USE-WEAR ***
1864	MW	E100,N115	Blank	1.85	WN	17.1	-	35	14	HDS
2000	LW	E108,N103	Blank	1.85	WN	12.5	-	34	11	LDS
1819	MW	E95,N115	Scraper	1.81	WN	25.0	47	32	17	LDS
1911	LW	E105,N115	Fragment	1.78	WN	4.4	-	-	9	HDC
1916	MW	E105,N115	Fragment	1.84	WN	14.7	-	-	12	-
1920	MW	E105,N115	Fragment	1.97	WN	8.5	-	-	7	GC
1934	LW	E105,N120	Fragment	1.69	WN	4.7	-	-	10	-
SCRAPER CUT										
2054	LW	E108,N129	Fragment	1.56	WN	11.7	-	-	11	HDS

*MP=May Brook Phase, MW=Middle Woodland, LW=Late Woodland
**WN=Winterset, AR=Argentine, NLW=Non-Local White, WS=Westerville, +=Heated
***GC=General Cutting, GS=General Scraping, IF=Impact Fracture, LDS=Light-Duty Scraping,
HDS=Heavy-Duty Scraping, HDC=Heavy-Duty Cutting, GI=Graving/Incising, BP=Boring,Piercing,
X=Not Available for Analysis

All of the bifacial knives exhibit moderate to pronounced abrasional use-wear. Six exhibit general cutting wear, two heavy-duty cutting wear and one graving or incising use.

Bifacial Blanks (n=14)

The 14 bifacial blanks range from thick bifaces with primary bifacial thinning to bifaces with secondary thinning and shaping approaching the final tool outline (Figure 33k-l). Most were manufactured from tabular or block cores although at least three were made from stream-rolled cobbles. All are Winterset chert, except for a single specimen made of non-local white chert.

Ten bifacial blanks were recovered from the Middle Woodland component, three from the Late Woodland and one from the May Brook phase component. Thirteen blanks exhibit use-wear including two with light-duty and two with heavy-duty scraping wear, seven with general scraping wear and two with heavy-duty cutting wear.

Bifacial Scrapers (n=10)

Ten bifacial scrapers were recovered including three circular, two ovate and five irregular forms. These were generally shaped by primary bifacial flaking followed by steep unifacial retouch. Three scrapers from the 1979 test excavations were not available for study although descriptive data from the 1979 report has been included.

Five bifacial scrapers are from the Middle Woodland component (Figure 34a) including three circular scrapers missing from the collection and two irregular scrapers. The circular scrapers were Winterset chert with one exhibiting evidence of heating. One irregular scraper is unheated Winterset chert and the other is unheated Westerville chert.

The three bifacial scrapers from the Late Woodland component include two ovate (Figure 34b-c) and one irregular scraper. All are of Winterset chert. One of the ovate specimens has a notch prepared on a lateral margin (Figure 34c).

Two scrapers were recovered from the May Brook phase component. One large specimen appears to have been hafted and is made from unheated Westerville chert (Figure 34d). The other is a large irregular scraper made from unheated Winterset chert (Figure 34e).

Six of the seven scrapers available for analysis exhibit use-wear, including two with heavy-duty scraping wear, two with light-duty scraping wear and two with general scraping wear.

Bifacial Fragments (n=23)

The 23 biface fragments include five thick fragments which appear to be segments of broken bifacial blanks. Ten fragments are distal tips or mid-sections of thin bifaces, such as points, knives or preforms, and eight are small fragments. Twenty fragments are unheated Winterset chert, two are heated Winterset and a single specimen is non-local heated white chert.

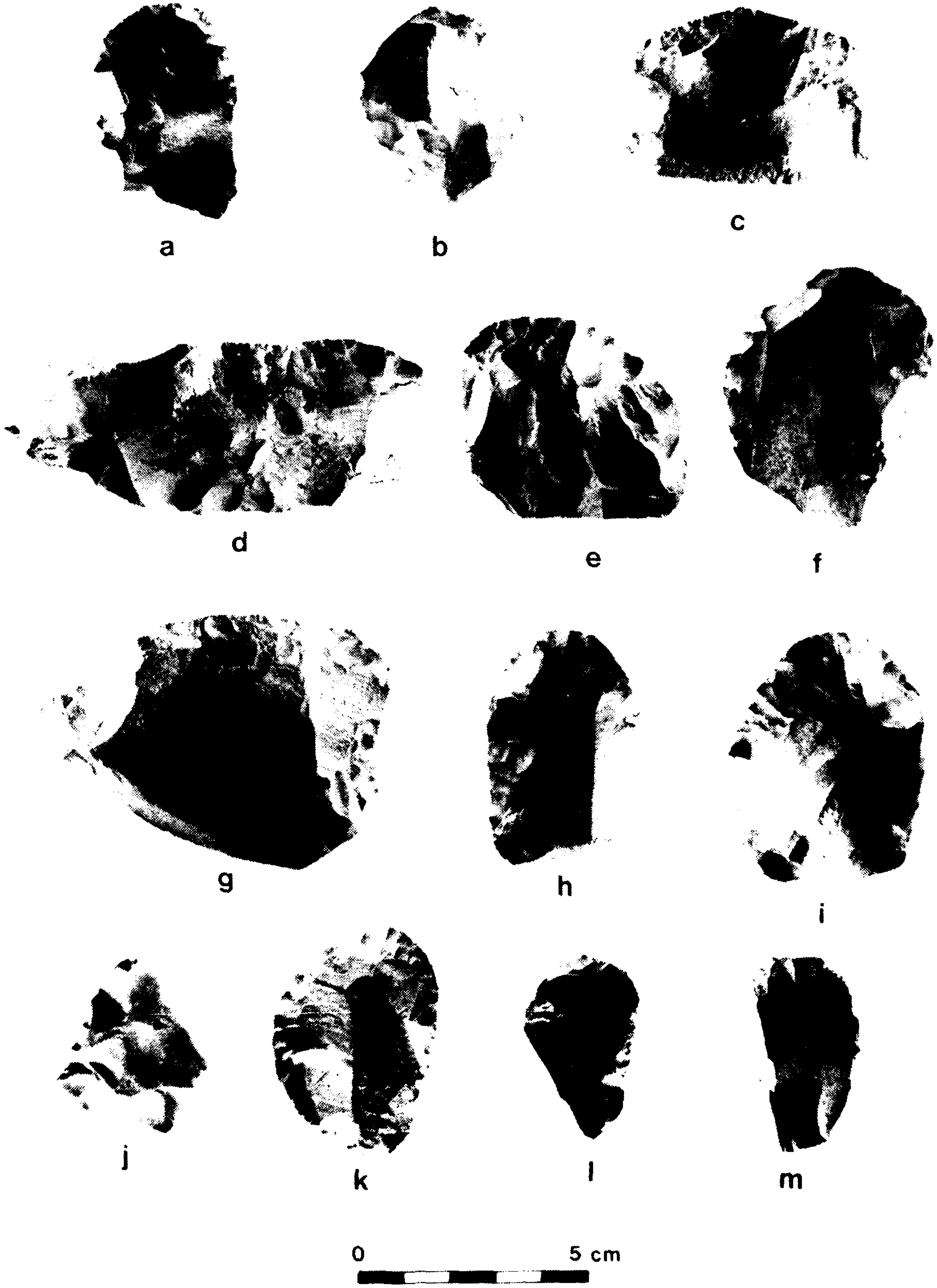


Figure 34. Scrapers from 23JA238: a, Middle Woodland bifacial scraper; b-c, Late Woodland bifacial scrapers; d-e, May Brook phase bifacial scrapers; f, Middle Woodland unifacial scraper; g-i, Late Woodland unifacial scrapers; j, Middle Woodland flake scraper, k-l, Late Woodland flake scrapers; m, May Brook phase flake scraper.

Sixteen biface fragments are associated with the Middle Woodland component, four with the Late Woodland component and three with the May Brook phase component. Six biface fragments exhibit general cutting wear, one has heavy-duty cutting wear, one has light-duty scraping wear, two have heavy-duty scraping wear and two have general scraping wear.

Unifacial Scrapers (n=18)

The 18 unifacial scrapers recovered were generally manufactured from thick flakes or tabular pieces of chert modified by moderate to steep invasive unifacial retouch (Figure 34f-i). Eight specimens from the 1979 test excavations were not available for analysis, although information on these specimens is included (Table [illegible]). Seven unifacial scrapers are end scrapers, three are side scrapers, four are ovate which have working edges extending around nearly the entire perimeter of the total and four are fragments.

Eleven scrapers are from the Middle Woodland component, including four end scrapers, three ovate scrapers, two side scrapers and two fragments (Figure 34f). Nine are Winterset chert and two are non-local heated cherts. The three specimens available for use-wear analysis include two with general scraping wear and one with light-duty scraping wear.

The seven unifacial scrapers from the Late Woodland component include one large side scraper (Figure 34g), three end scrapers (Figure 34h-i), one ovate scraper and two fragments. The side scraper exhibits pronounced light-duty scraping wear, three end scrapers and a fragment exhibit light-duty scraping wear, while the ovate scraper has general scraping wear and a final fragment has heavy-duty scraping wear. All seven are made of Winterset chert and only two have been heated.

Notch (n=1)

A single notch prepared on a Winterset core fragment was recovered from the Middle Woodland component. This specimen was not available for analysis.

Flake Scrapers (n=11)

Three flake scrapers were recovered from the Middle Woodland component, four specimens from the Late Woodland component and four from the May Brook phase component (Figure 34j-m). The flake scrapers are generally made from thin small flakes. A single specimen is a non-local white chert, two are Westerville chert and eight are Winterset chert. Nine flake scrapers have use-wear, including three with general scraping wear and one with heavy-duty scraping wear.

Perforator (n=1)

A Winterset bladelet recovered from the Middle Woodland component has been retouched on one lateral margin forming a projection suitable for perforating.

Edge-Modified Debitage (n=188)

A total of 188 pieces of edge-modified debitage were recovered from 23JA238, including 178 flakes, six chunks and four cores. The edges of these tools exhibit use-wear or retouch. Thirty-seven of the tools were

Table 51. Descriptive data for unifacial and marginally retouched tools from 23JA238.

CAT. NO.	COMPO- NENT*	PROVENIENCE	TOOL TYPE*	CHERT TYPE **	USE- WEAR ***	DATUM DEPTH (m)	WEIGHT (g)	DIMENSIONS (mm) Length	Width	Thickness
BLOCK A										
76	MP	E100,N99	Scraper	WS	GS	2.55	10.3	39	35	8
112	MP	E100,N100	Scraper	WN	LDS	2.89	10.5	44	25	10
137	MP	E101,N99	Scraper	WN	-	2.63	7.9	38	27	8
215	MP	E103,N99	Scraper	WS	GS	2.43	3.0	20	18	7
BLOCK B										
17	MW	E86,N110	Scraper	NL+	NA	1.91	26.6	56	37	15
32	MW	E86,N110	Scraper	WN	NA	2.06	11.9	54	33	13
33	MW	E86,N110	Scraper	WN	NA	2.08				8
34	MW	E86,N110	Scraper	WN	NA	2.07	40.4	49	44	23
270	MW	E86,N109	Scraper	TWN	NA	1.97	21.8	49	46	16
271	MW	E86,N109	Perforator	WN	BP	1.93	2.9	39	18	4
314	MW	E87,N109	Notch	WN	X	1.97	73.8	57	55	31
316	MW	E87,N109	Scraper	WN	X	2.00	61.9	67	46	29
410	MW	E88,N110	Scraper	WN	X	1.97	29.8	31	30	24
690	MW	E87,N111	Scraper	WN	-	1.92	13.5	-	40	12
825	MW	E90,N111	Scraper	WN	GS	1.88	23.0	53	32	15
888	LW	E92,N111	Scraper	WN	GS	1.58	22.0	58	42	9
1140	MW	E96,N110	Scraper	NLW+	LDS	1.89	6.0	37	32	5
1184	MW	Feature 7	Scraper	WN	HDS	2.18	12.5	42	34	11
BLOCK C										
1335	LW	Feature 5	Scraper	WN	LDS	1.54	12.9	50	36	11
1367	LW	E87,N118	Scraper	WN	LDS	1.75	97.2	76	56	22
1381	LW	E87,N119	Scraper	WN	LDS	1.71	33.6	52	37	17
1424	LW	E88,N119	Scraper	WN	LDS	1.62	17.0	39	29	20
1448	LW	E88,N121	Scraper	WN	LDS	1.68	12.7	60	35	16
1631	LW	E91,N119	Scraper	WN	GS	1.69	18.6	53	27	11

continued

Table 51 continued. Descriptive data for unifacial and marginally retouched tools from 23JA238.

CAT. NO.	COMPO- NENT*	PROVENIENCE	TOOL TYPE*	CHERT TYPE **	USE- WEAR ***	DATUM DEPTH (m)	WEIGHT (g)	DIMENSIONS (mm) Length	Width	Thickness
TEST UNITS										
159	MW	E100,N106	Scraper	NL	NA	1.88	12.9	40	35	15
365	MW	E100,N107	Scraper	WN	GS	1.88	7.1	32	20	9
1823	MW	E95,N115	Scraper	WN	LDS	1.87	44.2	62	41	16
1880	LW	E100,N120	Scraper	WN	LDS	1.54	6.5	41	28	7
1942	LW	E105,N120	Scraper	WN	LDS	1.74	61.8	61	46	23
1963	LW	E115,N115	Scraper	WN+	LDS	1.76	19.3	48	29	14
1967	LW	E115,N125	Scraper	WN+	HDS	1.81	13.9	47	31	14

*MP=May Brook Phase, MW=Middle Woodland, LW=Late Woodland
**WS=Westerville, WN=Winterset, TWN=Tan Winterset, NL=Non-Local, NLW=Non-Local White, +=Heated
*** GS=General Scraping, HDS=Heavy-Duty Scraping, LDS=Light-Duty Scraping, BP=Boring/Piercing
NA=Not Available for Analysis,

intentionally retouched. Most were used briefly and then discarded. Both light and heavy-duty cutting and scraping activities are indicated in the assemblage.

A total of 111 edge-modified tools were recovered from the Middle Woodland component. This represents nearly two-thirds (64 percent) of the chipped stone tools from the component. A total of 55 edge-modified tools were recovered from the Late Woodland component (65 percent), while 17 (52 percent) were recovered from the May Brook phase occupation. An additional seven edge-modified flakes recovered from the test units, scraper cuts and disturbed levels cannot be assigned to a specific cultural component.

Lithic Manufacturing Debris

The lithic manufacturing debris recovered from 23JA238 includes 25 cores, 44 chunks, 919 pieces of shatter, 1241 flakes and 1642 chips.

Cores (n=25)

A total of 25 cores and pieces of procured raw material were recovered (Table 52). Eight cores were from the Middle Woodland component, 13 from the Late Woodland component and two from the May Brook phase occupation. Two cores from the test units were not culturally assignable. Four cores from the 1979 test excavation were not available for analysis. From the metric data presented by Schmits and Reust (1982b), they appear to be tabular or block Winterset cores. The remaining 21 cores recovered in 1983-1984 include 18 Winterset cores and three Westerville cores. Only one Winterset core has been heated.

The cores from 23JA238 are characterized by irregular platforms and non-patterned flake removal. A majority are either small fragments (n=10) or core nuclei (n=3). The complete cores include four tabular specimens and one block core. All of the complete cores are small in size with the exception of one fairly large specimen from the Late Woodland component. The three pieces of procured raw material recovered include two tabular pieces and one stream-rolled cobble.

Chunks (n=44)

A total of 44 chunks were recovered. A total of 29 can be assigned to the Middle Woodland component, five to the Late Woodland component and ten to the May Brook phase component. All of the chunks are of Winterset chert.

Shatter (n=919)

A total of 919 pieces of shatter were recovered including 627 pieces from Middle Woodland component, 241 from the Late Woodland component, 19 from the May Brook phase component and 32 from unknown cultural deposits. Nearly all of the shatter is Winterset chert.

Flakes (n=1241)

A total of 1241 flakes were recovered including 872 from the Middle Woodland component, 237 from the Late Woodland component, 48 from the May Brook phase component and 84 from unknown cultural deposits. A

Table 52. Descriptive data for cores and procured raw material from 23JA238.

CATALOG NUMBER	PROVEN-IENCE	COMPON-ENT**	DATUM DEPTH (m)	CORE TYPE ***	CHERT TYPE ****	WT. (g)	DIMENSIONS (mm) LGTH	WDTH	THICK-NESS
BLOCK A									
202*	E102,N100	MP	2.58		WN	60	66	56	20
588	E100,N101	MP	2.54	Fragment	WS	38	51	42	34
633	E103,N102	UNK	1.60	Nuclei	WN	47	49	38	32
BLOCK B									
313*	E87,N109	MW	1.93		WN	76	58	58	26
315*	E87,N109	MW	1.96		WN	136	69	55	32
671	E86,N111	MW	2.02	Fragment	WN	23	38	34	21
697	E87,N111	MW	2.07	Fragment	WN+	26	46	34	21
749	E89,N109	MW	1.95	Nuclei	WN	24	36	34	26
901	E93,N111	LW	1.66	Fragment	WN	58	74	47	31
906	E94,N109	LW	1.56	Fragment	WN	58	56	39	23
1033	E95,N110	MW	1.89	Tabular	WN	171	95	73	42
945	Feature 8	MW	2.00	Fragment	WN	17	43	30	20
1185	Feature 7	MW	2.10	Fragment	WN	50	84	45	21
2042	E93,N110	LW	1.62	Fragment	WN	33	49	29	21
BLOCK C									
1412	E88,N117	LW	1.46	Fragment	WS	13	41	22	21
1468	E88,N124	LW	1.65	Tabular	WN	113	69	55	33
1479	E89,N119	LW	1.54	Block	WS	106	60	48	43
1482	E89,N119	LW	1.63	PRM	WN	279	104	59	52
1495	E89,N121	LW	1.55	Fragment	WN	80	62	41	28
1564	E90,N120	LW	1.61	PRM	WN	240	107	64	51
1576	E90,N121	LW	1.63	Nuclei	WN	35	50	37	27
1600	Feature 16	LW	1.72	Tabular	WN	33	50	32	19
TEST UNIT									
366*	E100,N107	UNK	1.88		WN	89	77	43	32
1900	E105,N110	LW	1.85	PRM	WN	258	89	48	38
SCRAPER CUT									
2055	E102,N126	LW	1.63	Tabular	WN	520	138	94	51

*=Missing Phase II artifacts
**MP=May Brook Phase, MW=Middle Woodland, LW=Late Woodland, UNK=Unknown
***PRM=Procured Raw Material
****WN=Winterset, WS=Westerville, +=Heat Treated

sample of 129 flakes examined from the Middle Woodland component included five decortication flakes, 62 intermediate flakes and 62 bifacial trimming flakes, indicating little primary lithic reduction during the Middle Woodland occupation. Nine (7 percent) are non-local white cherts.

A sample of 82 flakes examined from the Late Woodland component include three decortication flakes, 48 intermediate flakes and 31 bifacial trimming flakes. A single specimen was of non-local white chert.

Only 16 flakes were recovered from the 1983-84 investigations of the May Brook phase component, including three decortication flakes, ten intermediate flakes and three bifacial trimming flakes. The debitage from the 1979 investigations was not available for analysis. However, Schmits and Reust (1982b) characterized these flakes as representing the final stages of lithic reduction.

Chips (n=1642)
A total of 1330 chips were recovered from the Middle Woodland component, 227 from the Late Woodland component, 45 from the May Brook phase component and 40 which cannot be assigned to any of these components with certainty.

Ground Stone Tools

Two ground stone artifacts were recovered from 23JA238. Both are from the Middle Woodland component. Included is a small metate made from a thick tabular block of limestone. The surface of one side is worn to a depth of about 4 mm. The other artifact is a small fragment which appears to be a section of a mano made from reddish-brown quartzite.

Minerals

Eleven minerals were recovered including seven small abraded pieces of hematite, two tabular hematite chunks and two samples of hematite ground into red ocher. Seven pieces of hematite are from the Middle Woodland component, one from the Late Woodland component and one from unassigned cultural deposits. The two concentrations of ocher are from the Late Woodland component. The hematite ranges in color from reddish-brown to purplish-red. Five specimens are soft and easily abraded and one fragment is hard. A reddish-purple tabular chunk appears to be very hard and is highly polished.

Unworked Stone

A total of 773 pieces of unworked stone with a combined weight of nearly 71 kg were recovered from 23JA238 (Table 53). Over 99 per cent of this material consists of limestone cobbles or fragments and the remainder are sandstone fragments. As Table indicates, nearly all

of the recovered limestone (97 per cent) was heated, indicating its use as hearthstones. The Middle Woodland component produced 80 heated pieces of limestone and two pieces of heated sandstone. The Late Woodland component produced 635 pieces of heated limestone, one piece of heated sandstone, 24 pieces of unheated limestone and one piece of unheated sandstone. The May Brook phase component produced 27 pieces of heated limestone. Three pieces of unworked stone were from unassigned test units. About one-half (57 percent by number, 46 percent by weight) of the limestone was recovered from features and the remainder came from the excavation units.

Table 53. Unworked stone from 23JA238.

TOTAL	HEATED				UNHEATED				TOTAL	
	Limestone		Sandstone		Limestone		Sandstone		Unworked Stone	
	No.	Wt (g)	No.	Wt (g)	No.	Wt (g)	No.	Wt (g)	No.	Wt (g)
MIDDLE WOODLAND										
Exc. Units	49	5125							49	5125
Features	31	6138	2	83					33	6221
Total	80	11,263	2	83					821	11,346
LATE WOODLAND										
Exc. Units	240	29,012	1	38	14	1507	1	75	256	30,632
Features	395	24,783			10	408			405	25,191
Total	635	53,795	1	38	24	1915	1	75	661	55,823
MAY BROOK										
Exc. Units	16	2397							16	2397
Features	11	1260							11	1260
Total	27	3657							27	3657
UNKNOWN AND MIXED										
Exc. Units	3	118							3	118
Features										
TOTAL										
Exc. Units	308	36,652	1	38	15	1507	1	75	324	38,272
Features	437	32,181	2	83	10	408			449	32,672
TOTAL	745	68,833	3	121	24	1915	1	75	773	70,944

FAUNAL REMAINS

The faunal assemblage from 23JA238 consists of a total of 651 complete and fragmentary bones and teeth. A total of 46 of these are identifiable, comprising nine taxa and 14 individuals (Table 54). Included are ten mammals, one bird, two turtles and one fish. For the most part, the faunal assemblage was well preserved indicating rapid post-depositional burial and favorable soil chemistry. Most of the bones were broken during butchering and processing. A large quantity of the bone was burnt. Analysis of the faunal remains was made to the most specific taxonomic level possible, utilizing the comparative collections at the University of Kansas Museum of Natural History.

Wapiti (Cervus elaphus canadensis) remains include three mandibular cheek teeth (right P_2-P_4) in a fragment of the ramus, and a fragment of molar enamel; these indicate the presence of a single individual. All of these are from the Late Woodland component. The lower premolars and ramus were recovered from a large burnt rock concentration (Feature 5). The mandibular ramus has several deep marks on the lingual and buccal sides of the diastema on the alveolar border. It is difficult to positively ascertain whether these are the gnaw marks of a rodent or the marks of butchering. Wapiti are primarily grazers which inhabit prairies and semi-open woodlands.

White-tailed deer (Odocoileus virginianus) remains include 22 elements from a minimum of four individuals. White-tailed deer are inhabitants of open woodlands, forests, and the wooded banks of water courses. Odocoileus remains from the Middle Woodland component include a metapodial, a sesamoid bone from Feature 2, two associated teeth, and one lumbar vertebra. A single individual is indicated by these remains.

A total of 15 identifiable Odocoileus elements were recovered from the Late Woodland component. More than half of these were in Feature 16. A minimum of two individuals are indicated by eight teeth or tooth fragments, two right cubonaviculars, a proximal and ungual phalanx, one lumbar vertebra, a metapodial and rib fragment. Based on the eruption and wear sequences established by Severinghaus (1949) for Odocoileus teeth, the four complete teeth from the Late Woodland component are of two individuals one being aged 17 months and one seven and one half years. Three bones from this component bear butchering marks. Both cubonaviculars have cut marks either on the astragalar facet or on the anterior surface. The distal phalanx has four deep incisions on the plantar aspect of the flexor tuberosity.

A single Odocoileus individual in the May Brook phase component is indicated by a left os coxa recovered from Feature 28 and a right proximal tibia.

Two distal right humeral fragments of the raccoon (Procyon lotor), one of the diaphysis and the other of the trochlea and capitulum, were recovered from the Late Woodland component. Since the interconnecting bone is missing, both should be regarded as from a single individual. The raccoon is common in western Missouri and inhabits forests and

Table 54. Distribution of identified faunal remains from 23JA238.

	MIDDLE WOODLAND	LATE WOODLAND	MAY BROOK PHASE	UNKNOWN	TOTAL
Cervus elaphus canadensis wapiti		4			4
Odocoileus virginianus white-tailed deer	5	15	2		22
Procyon lotor raccoon		2			2
Sylvilagus floridanus eastern cottontail		1			1
Microtus ochrogaster prairie vole		11			11
Meleagris gallopavo turkey		1			1
Trionyx sp. softshell turtle		2		1	3
Emydinae emydine turtle		1			1
Pisces fish	1				1
TOTAL	6	37	2	1	46

woodland edges, especially near water.

A single eastern cottontail (*Sylvilagus floridanus*) is indicated by a left P_4 from the Late Woodland component. Eastern cottontails inhabit broken forests, forest edges, heavy brush and weed patches.

Prairie vole (*Microtus ochrogaster*) remains were represented by two right mandibular first molars and a left ramus with M_1-M_3 from Feature 33 and associated with the Late Woodland component. Additional remains which compare favorably with this species include one left and three right lower incisors from Feature 33. Two right upper incisors from Features 5 and 32 may indicate the presence of a minimum of three individuals. The prairie vole occurs in dry to moderately moist prairie communities with sparse to thick grass cover in which they make shallow tunnels. The prairie vole also inhabits shrubby areas and forest borders. This species was probably intrusive rather than representing a faunal resource exploited by the site's occupants.

The shaft of a left humerus of a turkey (*Meleagris gallopavo*) recovered from Feature 16 and associated with the Late Woodland component is the single avian element recovered from 23JA238. The common turkey roams in small flocks in woodlands and mixed open forests.

The softshell turtle (Trionyx sp.) is represented by three fragmentary pleural bones (carapace fragments). While two of these have been collected from the Late Woodland Feature 33, the third is from disturbed deposits overlying May Brook phase deposits in a test unit just northeast of Block A. The latter articulates with one of the former, indicating the presence of a single individual. Two species of soft-shell turtle occur in western Missouri including the midland smooth softshell (Trionyx muticus) and the western spiny softshell (T. spiniferus). Both are semiaquatic, but while the midland smooth soft-shell prefers sand or mud bottoms of moderate to fast-flowing streams and rivers, the western spiny softshell is found in a variety of habitats including swift-flowing courses to still-water oxbow lakes. Both species are active from April to October.

A marginal carapace bone from the Late Woodland component indicates the presence of a single member of the turtle subfamily Emydinae. This subfamily includes most of the semiaquatic and terrestrial turtles in western Missouri including map turtles (genus Graptemys), sliders and painted turtles (genus Chrysemys), and box turtles (genus Terrapene).

Fish remains were represented by a single vertebra from the Middle Woodland component. Identification to a specific level was not possible.

The faunal remains recovered from 23JA238 represent all environmental zones in the area of the site. Softshell turtles and fish were available from the Little Blue River. Deer, raccoon and turkey were probably hunted in the floodplain forest or, like wapiti and cottontails, in the woodland edge environment. Wapiti were also present in both the upland and lowland prairie. The prairie vole, though probably a post-occupational intrusive, indicates the near proximity of prairie or shrubby areas.

All species in the faunal assemblage, except fish, were collected from the Late Woodland component. Deer are the single mammalian species present in both the Middle Woodland and May Brook phase occupations, with the single specimen of fish occurring in the former and perhaps a softshell turtle in the latter. Based on the faunal assemblage, the occupants of 23JA238 focused their hunting activities in the open woodlands.

FLORAL REMAINS

The floral assemblage from 23JA238 consists of carbonized seeds and nutshells recovered from the flotation of midden and feature matrix samples at the site. The heavy and light fraction flotation samples from the features have been sorted, analyzed and found to contain 27 carbonized seeds and 1616 carbonized nutshells. These botanical remains were analyzed and identified by Ralph Brooks, Assistant Director of the University of Kansas Herbarium. Identifications were made to the most specific level possible.

Carbonized Seeds

The sample of identifiable carbonized seeds includes 23 specimens representing six taxa (Table 55). Information concerning the species present in the area and their preferred habitats has been based on Steyermark's (1963) Flora of Missouri. Much of the information concerning methods of seed dispersal and season of availability was supplied by Ralph Brooks.

Amaranthus sp. (amaranth) n=7

Seven carbonized amaranth seeds were recovered from Feature 33 and are associated with the Late Woodland component. Amaranths or pigweeds are annual herbaceous short broad bush-like plants up to 1 m in height which produce several thousand seeds. Seven native species are common in Jackson County (Steyermark 1963). They are found in disturbed mesic lowland settings and in waste areas. The seeds of these species are available in late August through October. Amaranth seeds are small, light and easily blown about or washed by rains.

Panicum sp. (panic grass) n=1

One *Panicum* seed associated with the Late Woodland component was recovered from Feature 13. Seventeen species of panic grass are native to Jackson County and are generally found in open areas that are underlain by chert, sandstone or granite providing acidic soil conditions (Steyermark 1963). The members of this wide ranging genus flower in both the spring and fall.

Phytolacca sp. (pokeweed) n=1

One *Phytolacca* seed associated with the May Brook phase component was recovered from Feature 1. One species, *P. americana*, is native to Jackson County and occurs in rich soils in disturbed areas and along forest margins (Steyermark 1963). The seeds are available from late June through October.

Portulaca sp. (purslane) n=10

Ten purslane seeds associated with the May Brook phase component were recovered from Feature 1. Two species, *P. oleracea* and *P. mundula*, are native to Jackson County. Purslanes are short, upright, mat-forming succulents 5-13 cm in height that occur in cultivated and waste ground and in rocky escarpments along bluffs (Steyermark 1963). Purslane seeds are borne in capsules from August through October. Each plant can produce several hundred seeds which are scattered on the ground by wind and water. *P. oleracea* was initially a tropical resident that has been carried north at some point in the past (Brooks: personal communication).

Rubus sp. (blackberry) n=1

One specimen of this large family was recovered from Feature 13 and is associated with the Late Woodland component. This genus includes blackberries, raspberries and dewberries which all occur in a variety of disturbed and forested contexts. The berries are generally available from June through August.

Table 55. Carbonized seeds and nutshells from the features at 23JA238.

	MIDDLE WOODLAND							LATE WOODLAND									MAY BROOK		
FEATURE	2	3	4	7	8	26	27	5	6	9	10	13	14	16	32	33	1	28	TOTAL
SEEDS																			
Amaranthus sp. pigweed																7			7
Panicum sp. panic grass												1							1
Phytolacca sp. pokeweed																	1		1
Portulaca sp. purslane																	10		10
Rubus sp. blackberry												1							1
Viola sp. violet																	3		3
Unidentified		1															3		4
Total		1										2				7	17		27
NUTSHELLS																			
Carya sp. hickory	11		8	1	26			36	9	19	29		8	667	22	10		13	859
Juglans nigra black walnut										2				5					7
Quercus sp. acorn															11				11
Unidentified	1		42			3	2	58	16	91	45		33	403	18	10		17	734
Total	12		50	1	26	3	2	94	25	112	74		41	1075	51	20		30	1616
TOTAL	12	1	50	1	26	3	2	94	25	112	74	2	41	1075	51	27	17	30	1643

Viola sp. (violet) n=3

Three carbonized violet seeds were recovered from Feature 1 and are associated with the May Brook phase component. Violets are small plants 10-15 cm in height which may occur in large patches. Eight species are represented in the Kansas City area including mesic-adapted species that occur in lowlands and xeric-adapted species that prefer rocky open woods, open ridges and prairies (Steyermark 1963). Several species flower in the spring, from May into June, and again in the fall, from September through early October. The spring bloom, however, would be the primary bloom (Brooks: personal communication).

Carbonized Nutshells

Carbonized nutshells recovered from 23JA238 include 877 identifiable and 739 unidentifiable fragments (Table 55). Three taxa including hickory nuts (*Carya* sp.), black walnuts (*Juglans nigra*) and acorns (*Quercus* sp.) were recovered. Thirty fragments are from the May Brook phase component, 89 fragments from the Middle Woodland component and 1492 fragments from the Late Woodland component.

Carya sp. (hickory) n=859

Forty-six of the hickory nut fragments are from the Middle Woodland component, 800 from the Late Woodland component and 13 from the May Brook phase component. Six species of hickory are present in Jackson County (Steyermark 1963). Included are species which occur in mesic lowland settings and species which occur in zeric upland woods. Hickory nuts are available from September through October (Stephens 1973) and were eaten widely throughout aboriginal North America (Yanovsky 1936). In many instances, they were gathered in the fall and stored for winter use.

Juglans nigra (black walnut) n=7

Seven fragments of black walnut shell were recovered from the Late Woodland component. This species occurs in rich woods at the base of slopes or bluffs, in valleys along streams, and in open and upland woods (Steyermark 1963). The nuts are available in October (Stephens 1973).

Quercus sp. (acorn) n=11

Eleven acorn shell fragments were recovered from the Late Woodland component. According to Steyermark (1963), nine species of oak are present in Jackson County. Included are mesic-adapted species located in lowlands and xeric-adapted species found on uplands and slopes. Acorns are principally available in October, although a few species, such as *Q. prinoides* and *Q. imbricaria*, are available in September (Stephens 1973).

The species of carbonized seed and nutshell remains from 23JA238 indicate a degree of variability in the use of floral resources between the three occupations at the site. The data from both the Middle Woodland and Late Woodland occupations indicate a fairly extensive utilization of mast resources from riparian or slope forest contexts. In contrast, the botanical remains from the May Brook phase component indicates the use of annual herbaceous plant resources in addition to

mast resources.

In terms of season of occupation, 23JA238 shows fairly uniform seasonal usage by the three cultural groups. Nearly all of the species recovered from the site are available from the latter part of the summer through the fall (Table 56). These data indicate that the site saw primary usage during the late warm weather and cool fall seasons by the Middle and Late Woodland and May Brook phase occupants.

DISCUSSION AND SUMMARY

The 1983-1984 data recovery investigations at 23JA238 indicate the presence of three distinct cultural components at the site. The oldest deposit consists of a Middle Woodland component located primarily from 40-70 cm below the surface in Block B and other test units. A later Late Woodland component is represented by a shallow deposit extending from the surface to a depth of 40 cm in Blocks C and D. The most recent deposit consists of the May Brook phase materials encountered along the bank of the East Fork of the Little Blue River in Block A and in three test units immediately to the northeast of Block A. These deposits have been buried by recent alluvial levee deposits.

The Middle Woodland Component

The Middle Woodland component at 23JA238 has been dated at 1620±45 and 1960±90 years B.P. While there is considerable variation between these two dates, both fall well within the Middle Woodland period confirming the chronological position of this component. Diagnostic artifacts associated with this deposit include contracting stemmed Langtry points and ceramics consisting of smoothed surfaced or smoothed-over cordmarked vessels with thick walls which were tempered with coarse sand or grit. The radiocarbon dates in association with the features, lithic assemblage and faunal and floral remains make this one of the most important sites in terms of understanding Middle Woodland adaptations in the Little Blue valley.

The Middle Woodland cultural deposit consists of a dense scatter of features, broken and discarded tools and lithic manufacturing debris, indicating the absence of specialized refuse disposal. This suggests that the occupation was fairly intensive but of short duration, perhaps extending over a single season. A total of eight features were recovered from the Middle Woodland component. Included are three hearths, three small rock hearths, an ash stain and a trash concentration. Presumably, the three hearths were used to heat the stones for the three smaller rock hearths. These features were scattered throughout Block B and other features were likely present nearby.

The lithic assemblage from the Middle Woodland component includes 171 chipped stone tools, two ground stone tools, 2866 pieces of

Table 56. Seasonal availability of floral resources recovered from 23JA238.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Amaranthus sp.								----	----	----		
Panicum sp.			----	----	----	----		----	----	----		
Rubus sp.						----	----	----				
Phytolacca sp.							----	----	----	----		
Portulaca sp.								----	----	----		
Viola sp.				----	----	----			----	----		
Carya sp.									----	----		
Juglans nigra										----		
Quercus sp.									----	----		

manufacturing debris, six minerals and 82 pieces of unworked stone. The 171 chipped stone tools include 60 formal tools and 111 informal edge-modified tools. The formal tools consist of nine projectile points, four bifacial knives, 10 bifacial blanks, 16 biface fragments, one notch, one perforator, and 19 bifacial, unifacial, and flake scrapers. The formal tools account for slightly over one-third (35.1 percent) of the chipped stone tools, while the remaining two-thirds (64.9 percent) of the tools are edge-modified debitage.

Analysis of use-wear on the formal tools from the Middle Woodland component indicates that 20 specimens were used for cutting and 17 specimens were used for scraping (Table 57). A single tool has graving/incising wear and another exhibits boring/piercing wear. Most of the implements with cutting wear are classified as general cutting tools which were used to cut both hard and soft materials. Three tools have heavy-duty cutting wear indicative of use on hard materials and one tool has light-duty cutting wear indicative of use on soft materials. Five implements exhibit wear indicative of scraping on hard materials, four indicate scraping of soft materials and eight are general scraping tools used on both hard and soft materials. Cutting wear is found only on bifacial tools, while scraping wear is found on both bifacial and unifacial tools. Impact fractures are also present on two Langtry points indicating their utilization as projectiles. Both of these points also exhibit general cutting wear.

The lithic manufacturing debris consists of 872 flakes, 29 chunks, 627 pieces of shatter, 1330 chips and eight cores. The relatively small number of chunks and cores from the Middle Woodland occupation indicate that the initial stages of lithic reduction were undertaken elsewhere. The few cores present are generally small or fragmentary, precluding further production of tools, except for small flake tools. Additionally, the recovered blanks are generally too small or fragmentary to have been further reduced to preforms or projectile points. The sample of flakes includes an overwhelming majority of intermediate and bifacial trimming flakes and very few decortication flakes, providing further evidence that the primary stages of lithic manufacture were accomplished elsewhere.

The frequencies of the chipped stone tools, the functions indicated by the use-wear present on their edges and the frequencies and types of lithic manufacturing debris present suggest that the following activities occurred at the site during the Middle Woodland occupation: hunting (projectile points and impact fractures); butchering (bifacial knives and cutting use-wear); hideworking (scrapers and the perforator, scraping wear and boring/piercing wear); hardwood, bone or antler working (heavy-duty cutting and scraping wear, graving/incising wear); woodworking (notch, light-duty scraping and cutting wear); secondary lithic reduction and tool maintenance (high percentage of bifacial trimming and resharpening flakes); mineral processing (hematite); and processing of plant foods (metate and mano).

About 85 percent of the tool assemblage from the Middle Woodland component consists of local Winterset chert, five percent is other

Table 57. Use-wear modifications on the chipped stone tool assemblage from 23JA238.

	GENERAL CUTTING	LIGHT-DUTY CUTTING	HEAVY-DUTY CUTTING	GENERAL SCRAPING	LIGHT-DUTY SCRAPING	HEAVY-DUTY SCRAPING	GRAVING/ INCISING	BORING/ PIERCING	TOTAL USE MOD.	TOTAL TOOLS*
MIDDLE WOODLAND										
Projectile Points	8								8	9
Bifacial Knives	2		1				1		4	4
Bifacial Blanks	1	1	2	4		2			10	10
Bifacial Scrapers					1	1			2	2
Biface Fragments	5			2	1	1			9	16
Unifacial Scrapers				2	1				3	3
Flake Scrapers					1	1			2	3
Perforator								1	1	1
Total	16	1	3	8	4	5	1	1	39	48
LATE WOODLAND										
Projectile Points	1		1		1		1		4	6
Drill								1	1	1
Bifacial Knives	3								3	3
Bifacial Blanks				1	2				3	3
Bifacial Scrapers				2					2	3
Biface Fragments			1			1			2	4
Unifacial Scrapers				1	5	1			7	7
Flake Scrapers					3				4	4
Total	4		2	5	11	2	1	1	26	31

continued

Table 57 continued. Use-wear modifications on the chipped stone tool assemblage from 23JA238.

	GENERAL CUTTING	LIGHT-DUTY CUTTING	HEAVY-DUTY CUTTING	GENERAL SCRAPING	LIGHT-DUTY SCRAPING	HEAVY-DUTY SCRAPING	GRAVING/ INCISING	BORING/ PIERCING	TOTAL USE MOD.	TOTAL TOOLS*
MAY BROOK PHASE										
Projectile Points										4
Bifacial Knives	1		1						2	2
Bifacial Blank				1					1	1
Bifacial Scrapers					1	1			2	2
Bifacial Fragments	1								1	3
Flake Scrapers				2	1				3	4
Total	2		1	3	2	1			9	16
TOTAL	22	1	6	16	17	8	2	2	74	95

*11 tools not available for analysis are not included.

semi-local Kansas City Group cherts and ten percent is non-local cherts, the majority of which are white cherts from Mississippian System outcrops in central or southwest Missouri. Sixty-seven percent of the non-local chert tools have been heated, while only 4 percent of the tools made from local cherts have been heated. As is indicated by these data, the Middle Woodland occupants predominantly made use of local lithic resources. The presence of non-local cherts, however, provides evidence of considerable mobility or trade with neighboring cultural groups to the east or southeast.

Faunal remains associated with the Middle Woodland component are restricted to white-tailed deer and the floral remains are primarily restricted to hickory nuts, which were recovered from five of the Middle Woodland features. While the sample of these remains is much too small for definitive assessment, it appears that subsistence efforts were focused on the upland deer and mast harvest. Furthermore, these remains suggest that the site was occupied during the late summer or fall.

The question of whether the Middle Woodland component at 23JA238 represents an ancillary extractive camp associated with a Kansas City Hopewell base camp or a local non-Hopewellian Middle Woodland occupation is problematical. As discussed above, the site clearly represents a short-term occupation probably occupied during the late summer or fall, and as such, it obviously represents a component of a broader settlement pattern. The logical way to evalute these alternative interpretations would be by stylistic similarity of the assemblage from 23JA238 to other Kansas City Hopewell assemblages. Unfortunately, no Middle Woodland rim sherds were recovered from 23JA238 and it is not possible to evaluate this relationship on ceramic grounds. The Middle Woodland projectile points from 23JA238 are primarily contracting stemmed Langtry points, and on this basis, the site differs from most Kansas City Hopewell sites where the point assemblages typically consist of a higher percentage of notched Snyders, Marshall or Steuben forms. A small percentage of points from Kansas City Hopewell sites appear to be contracting stemmed points (Shippee 1967, Bell 1976, Roedl and Howard 1957), although Shippee has reported a large number from the Shields site, located in Clay County north of the confluence of the Little Blue and Missouri rivers.

Langtry points have been found on a number of other Woodland sites along the Little Blue drainage, although they have only been dated at 23JA238. Roper (1983:177) has suggested the presence of a Woodland complex dominated by Langtry points along the Osage drainage. Many of the Osage basin sites appear to be similar to those in Jackson County in that they represent small sites where few ceramics are present. The only site where this complex has been dated along the Osage drainage is at Boney Springs along the Pomme de Terre River (Wood 1976:102). There, dates of 1900±80, 1910±80 and 1920±50 years B.P. were obtained on an assemblage characterized by Langtry points. In general, it would appear that a distinction can be drawn between Kansas City Hopewell occupations characterized by Havanna Tradition ceramics and sites along the Little Blue drainage characterized by Langtry points. We suspect that the latter represent local Middle Woodland populations derived from an earlier Early Woodland base which had minimal involvement with the

Hopewell Interaction sphere.

The Late Woodland Component

The Late Woodland component at 23JA238 has been radiocarbon dated at 1310±60 and 1390±60 years B.P. (A.D. 560-640) and is characterized by Steuben points and thin plain surfaced ceramics tempered with fine sand or grit. A small percentage of the ceramics have crenated lips. This Late Woodland occupation at 23JA238 is designated as the Woods Chapel phase. The Woods Chapel phase appears to be a transitional entity, chronologically positioned between the earlier Middle Woodland occupations in the Little Blue valley and the Late Woodland period as represented at the Sperry site (Brown 1981). The Woods Chapel phase represents a cultural complex which previously was almost entirely unknown in the Little Blue valley. However, it appears to be more widespread in the Kansas City area, and recently Johnson (1983) has referred to it as the early Late Woodland period. Previously, the Late Woodland period in the Little Blue drainage had been represented only by the Sperry site (23JA85), which was dated to a slightly later period of 1145-1255 years B.P., and which was characterized by smaller arrow points and a high percentage of cordmarked ceramics (Brown 1981). The Late Woodland Woods Chapel phase at 23JA238 therefore can be considered as an early Late Woodland occupation.

A total of 18 structural features are associated with the early Late Woodland Woods Chapel phase component at 23JA238. Included are three rock hearths, three hearths, a pit, a clay-filled basin, a daub concentration, a charcol scatter, an ash scatter and seven post molds. The majority of the features are located in Block C and are associated with the habitational structure defined as Structure 1. Two hearths are located to the east of the structure in Scraper Cut 1. A third hearth and a clay-filled basin are located to the southwest in Block D.

Structure 1 appears to be an oval habitational dwelling approximately 8 m in length by 5 m in width with the maximum dimension oriented along a northwest to southeast axis. A pit (Feature 16) was located in the northeastern corner of the structure, two hearths in the central area (Features 10 and 14) and a pit and rock hearth near the southwestern margin. The proximity of these features to the southeastern edge of the structure suggest that this area may have been open. The floor of the structure contained a relatively small amount of debris, mainly tools, suggesting that specialized refuse disposal occurred elsewhere. Consequently, it is likely that the Woods Chapel phase occupation at 23JA238 was of considerable duration, perhaps extending over several seasons, or for a year or more.

The lithic assemblage from the Woods Chapel phase component includes 84 chipped stone tools and 723 pieces of lithic manufacturing debris. Two minerals and 661 pieces of unworked stone were also recovered. The formal chipped stone tools include six projectile points, a drill, three bifacial knives, three bifacial blanks, three bifacial scrapers, four biface fragments, and eleven unifacial and marginally retouched scrapers. Fifty-three pieces of edge-modified

debitage were also present. The higher percentage of formal tools indicates that this is a more highly curated assemblage than the earlier Middle Woodland assemblage from the site.

Use-wear analysis of the formal tools indicates a low incidence of cutting activities and a high incidence of tools used for scraping during the early Late Woodland occupation (Table 57). Cutting wear is present on 11 tools, including four general cutting tools, used to cut both hard and soft materials and two heavy-duty cutting tools used on hard materials. Scraping wear is present on 18 tools including 11 tools with light-duty scraping wear indicating that predominately softer materials were being worked. Two tools have heavy-duty scraping wear, indicating use on hard materials and five are general scraping tools used on both hard and soft materials. Graving/incising and boring/piercing use-wear are present on single tools. Two projectile points exhibit impact fractures indicating their use as projectiles.

The lithic manufacturing debris consists of 237 flakes, five chunks, 241 pieces of shatter, 227 chips and 13 cores. This material contains a lower percentage of chunks and bifacial trimming flakes suggesting less emphasis on initial lithic reduction and more of an emphasis on final reduction and tool maintenance.

The frequencies of the chipped stone tools, analysis of the wear present on their edges and the relative frequencies of the manufacturing debris suggests that the following activities occurred during the early Late Woodland Woods Chapel phase occupation: hunting (projectile points, impact fractures); butchering (bifacial knives, cutting use-wear); hideworking (scrapers and the drill, light-duty scraping use-wear, boring/piercing use-wear); working of hard materials such as bone, antler or hardwoods (heavy-duty cutting use-wear, graving/incising use-wear); chipped stone tool manufacture and maintenance (cores and debitage); and mineral processing (ocher). The dominant activities appear to be hunting, hideworking and chipped stone tool manufacture and maintenance.

The lithic assemblage indicates that lithic procurement was focused on local Winterset cherts, since over 90 percent of the formal tools are of this material. About 3 percent are Westerville chert and 6 percent are non-local white Mississippian cherts. Only 7 percent of the tools made of local and semi-local cherts exhibited evidence of heating, while both of the non-local white chert tools have been heated.

A broad range of faunal remains including wapiti (elk), white-tailed deer, raccoon, cottontail, turkey and turtle were recovered from the early Late Woodland Woods Chapel phase component. By virtue of their size, the elk and deer undoubtedly provided the bulk of calories. The large number of floral remains recovered primarily consist of hickory nutshells and a smaller number of black walnut and acorn shells. At least two seeds, including panic grass and blackberry, are also present. The Late Woodland subsistence pattern is more diverse than the earlier Middle Woodland occupation in terms of faunal procurement. Utilization of floral resources appears to have primarily focused on mast resources, and in this respect, is similar to the Middle Woodland

pattern at the site.

In summary, the data recovered from the early Late Woodland Wood Chapel phase occupation at 23JA238 indicates a chronological placement within the early Late Woodland period. Diagnostic artifacts include thin plain surfaced ceramics tempered with fine sand or grit, which occasionally have crenated lips, along with Steuben projectile points. Houses appear to be oval with interior hearths and pits. Subsistence appears to have been focused on a variety of faunal resources, while floral procurement was focused on mast resources. The most important faunal resources were elk and white-tailed deer.

The early Late Woodland Woods Chapel phase component at 23JA238 is comparable in most respects to the other early Late Woodland sites in the Kansas City area recently discussed by Johnson (1983). Other components representative of this period include the Young site (23PL4), the Yeo Site (23CL199) and 14MM26 located to the west in the Hillsdale Lake area of eastern Kansas. A radiocarbon date from the Young site associated with Late Woodland ceramics is 1340±75 years B.P. Dates from Yeo are variable ranging from 915-1850 years B.P. A date from 14MM26 is 1160±100 years B.P. Johnson (1983:105) also includes the Woodland component at the Sohn site (23JA110) within this early Late Woodland period. Radiocarbon dates from Sohn range from 1710-1800 years B.P. and Reeder (1978) originally assigned the site to the Middle Woodland period. While there is fairly substantial evidence for an early Late Woodland cultural unit in the Kansas City area, primarily characterized by plain sand tempered ceramics, the dates associated with these ceramics are variable. Only the date from the Young site appears to be consistent with the dates from 23JA238.

Johnson (1983) interprets the early Late Woodland sites in the Kansas City area to be terminal Kansas City Hopewell sites. He suggests that there was no major break in settlement-subsistence patterns from the Middle Woodland Kansas City Hopewell period to the early Late Woodland period with major villages being located near the mouth of the tributary streams and specialized sites toward the head waters continuing. However, the data from the Woods Chapel phase component appears to be contrary to this interpretation. Only one Hopewell-like sherd was recovered from the Late Woodland deposits at 23JA238, and this sherd could be associated with the earlier Middle Woodland occupation at the site. Additionally, there is clear evidence of stratigraphic separation between the Middle and Late Woodland components at 23JA238 indicating that two separate occupations are represented rather than one long continuous occupation. Furthermore, the early Late Woodland Woods Chapel phase component appears to be an occupation of considerable duration, as is evidenced by the structure and specialized refuse disposal. The site appears to consist of a residential site occupied over a considerable interval, rather than a specialized extracting camp associated with a more intensive occupation located elsewhere.

Consequently, a settlement pattern consisting of small hamlets scattered along tributary valleys appears to be characteristic of the

early Late Woodland Woods Chapel phase in the Little Blue valley, rather than a pattern involving base camps near the confluence of the Little Blue River and the Missouri River and extractive camps located farther upstream along the Little Blue River.

The May Brook Phase Component

The May Brook phase component at 23JA238 is located in Block A and has been dated at 680±65 years B.P (A.D. 1270). This date and the associated artifacts are similar to those from the May Brook site (Schmits 1982b) and the Seven Acres site (Brown 1981). Although the sample of materials from the May Brook phase component at 23JA238 is small, it provides additional information on May Brook phase adaptations in the Little Blue valley.

A total of three features were located in the May Brook phase deposits in Block A. Included are two rock hearths and a charcoal scatter. The rock hearth overlaid the charcoal scatter by at least 20 cm, suggesting that some deposition occurred during the May Brook phase occupation at the site. The May Brook phase component also extends a short distance to the northeast of Block A, as is indicated by the ceramics recovered from several test units. Overall, the May Brook phase component is characterized by a thin scatter of debris indicating a brief occupation. The small size of the components and its position in a low area subjected to inundation precludes the possibility that this component represents an occupation of any duration. The May Brook phase component at 23JA238 undoubtedly extended farther to the south and has been truncated by the erosional action of the East Fork of the Little Blue River in the recent past.

The lithic assemblage from the May Brook phase occupation includes 33 chipped stone tools including four projectile points, two bifacial knives, one bifacial blank, two bifacial scrapers, three biface fragments, four marginally retouched flake scrapers and 17 edge-modified flakes. A total of 124 pieces of lithic manufacturing debris and 27 unworked stones were also recovered.

The percentage of formal tools relative to edge-modified debitage is high, almost double that of the other components at the site. The formal tools exhibit use-wear indicating that two were used as general cutting tools on hard and soft materials, one has heavy-duty cutting wear indicating use on hard materials, three have general scraping use-wear, two have light-duty scraping wear and one has heavy-duty scraping wear.

The lithic manufacturing debris includes 48 flakes, 10 chunks, 19 pieces of shatter, 45 chips and two cores. The amount of manufacturing debris recovered is very small in relation to the number of tools present. The small sample of flakes present include decortication, intermediate, and bifacial trimming flakes, indicating that various stages of lithic reduction ocurred at the site.

Activities that took place at the site during the May Brook phase

occupation include hunting (arrow points); butchering (bifacial knives, cutting use-wear); scraping activities on both hard and soft materials (bifacial scrapers and general, light and heavy-duty scraping wear) and the manufacture of chipped stone tools.

The lithic assemblage from the May Brook phase occupation indicates the use of semi-local Kansas City Group chert resources, in addition to local Winterset cherts. Sixty-nine percent of the tools are Winterset chert, but 25 percent are Westerville chert. A single tool (6 percent) was made of non-local white Mississippian chert. Eighteen percent of the Winterset chert tools have been heated, while none of the tools made of other cherts were heated.

Faunal remains associated with the May Brook phase component are limited to white-tailed deer. Floral remains include a number of seeds, such as purslane and violet, and a number of hickory nutshells. The May Brook phase component evidences a broader use of floral resources than found in the earlier Middle and early Late Woodland components at the site.

Interpretation of the May Brook phase component is restricted by the limited area available for excavation. The occupational area may have originally been much more extensive. In most respects, the May Brook phase component appears to be similar to other May Brook phase occupations in the Little Blue valley (Schmits 1982b). These appear to represent short-term seasonal extractive camps rather than longer term more permanent occupations. They are likely associated with more permanent villages in the broader Kansas City vicinity. Recently, evidence of a May Brook phase structure has been located at the Vaughn-Estess site (23JA209) along the upper Blue River drainage to the west (Parisi 1985). Sites such as Vaughn-Estess could represent more permanent May Brook phase occupations.

Summary

In summary, the 1979-1984 excavations at 23JA238 document the presence of three stratified components, including Middle Woodland, early Late Woodland and Mississippian period May Brook phase occupations, at the site. The Middle Woodland occupation appears to be a shorter occupation, perhaps a seasonal late summer or early fall residential occupation, focused on the extraction of white-tailed deer and mast resources. As such, it could be an ancillary camp associated with a more permanent base camp elsewhere. Projectile points from the Middle Woodland are predominately Langtry points. This point type is not typical of Kansas City Hopewell sites and suggests that the Middle Woodland component may represent a component of a non-Hopewellian local Middle Woodland cultural complex that is poorly defined in the Little Blue valley.

The early Late Woodland component, referred to as the Woods Chapel phase, appears to be the most intensive of the three occupations of the site based on the structural remains present and the evidence of specialized refuse disposal. The dominant activities that took place

during this occupation appear to be hunting, hideworking and chipped stone tool manufacture. Subsistence was focused on a broad range of resources including elk, deer, raccoon and turkey, as well as the exploitation of mast resources. This component appears to be a residential hamlet occupied over a considerable interval.

The May Brook phase component likely represents a short term extractive camp, although the data available to support this interpretation is much more limited. Activities that took place during the May Brook phase component include hunting, butchering and scraping. Subsistence was focused on white-tailed deer and the procurement of both mast and herbaceous floral resources. The May Brook phase component appears to be similiar to other May Brook phase components in the Little Blue valley, in that it represents an extractive camp associated with more permanent base camps outside the Little Blue drainage.

CHAPTER VIII

PREHISTORIC CHRONOLOGY AND SETTLEMENT-SUBSISTENCE PATTERNS IN THE LITTLE BLUE VALLEY, WESTERN MISSOURI

Larry J. Schmits and Bruce C. Bailey

INTRODUCTION

The Little Blue River, located in Jackson County, Missouri is one of the few remaining tributaries of the Missouri River in the Kansas City area which has not been disturbed by urban expansion and industrialization. During the past decade a number of federally funded improvements have been located along the Little Blue River and its tributaries including the construction of Blue Springs and Longview Lakes and the channelization of the Little Blue River by the Kansas City District, U.S. Army Corps of Engineers. The Environmental Protection Agency has assisted with the construction of the Little Blue Valley Sewer District and the Federal Highway Administration has assisted with the construction of Interstate 470 which crosses the Little Blue valley. Federal involvement in these projects necessitated compliance with various cultural resource mandates requiring the inventory, evaluation and mitigation of National Register eligible properties.

The present archaeological investigations are part of a program designed to mitigate the impact of construction of Blue Springs and Longview Lakes on the cultural resources located in these project areas. The first phase of these investigations were conducted in 1979-1980 and consisted of the excavation and study of five archaeological sites and the testing of 29 sites at the Blue Springs and Longview Lake project areas to determine their significance (Schmits 1982). This phase was conducted by Soil Systems, Inc. (SSI) and also involved ancillary studies which focused on the geology and biotic resources of the Little Blue valley. The second phase of work, reported on in this volume, was conducted during 1983-1984 by Environmental Systems Analysis, Inc. (ESA) and followed up the SSI recommendations for additional mitigation work at 23JA155, 23JA238 and 23JA143 in the Blue Springs Lake Project area.

The research design developed by ESA for the 1983-1984 mitigation program delineated two major goals: (1) refinement of the cultural chronology of the Little Blue drainage, and (2) formulation of models of Archaic, Middle Woodland and Mississippian settlement-subsistence and lithic procurement patterns. This chapter summarizes the results of the

combined 1979-1980 and 1983-1984 mitigation programs. It discusses the geology and biotic resources of the Little Blue River valley and then applies these data to questions of Archaic, Middle Woodland and Mississippian settlement, subsistence and lithic procurement patterns.

GEOLOGY AND BIOTIC RESOURCES

The Little Blue River is a small tributary valley of the Missouri River incised into Pennsylvanian age shales and limestones. The valley is approximately 27 km in length and drains an area of roughly 673 square km. The valley walls are steep and covered with a regolith of weathered unconsolidated bedrock. The upper margins of the valley walls are frequently marked by outcrops of Bethany Falls limestone, a thick resistant unit up to three meters in thickness. Weathering under the Bethany Falls limestone often forms overhangs suitable as shelters. The upland bluffs overlooking the valley consist of heavily dissected ridges separated by ravines and intermittent streams leading to the Little Blue River. Interfluvial areas are rolling and generally covered by a mantle of Pleistocene loess which thins away from the Missouri River (Kopsick 1982).

Based on Kopsick's (1982) and Mandel's work (this volume), the valley of the Little Blue River principally consists of two surfaces referred to as the T-0 and T-1 terraces. The T-0 is a narrow slightly elevated surface closely parallelling the modern channel. The major portion of the remainder of the valley floor consists of the T-1 terrace which is elevated 4-5 meters above the present channel. The T-1 surface shows extensive evidence of past meandering by the river, as evidenced by abandoned channels and oxbow lakes. Many of these relict channel positions are presently depressional wetland areas.

Radiocarbon dates and diagnostic artifacts from archaeological sites indicate that the surface of the T-1 terrace dates from about 2000-2400 years B.P. A radiocarbon date from near the base of the terrace fill is 8060±90 years B.P. Dates from the mid-section of the T-1 terrace fill range from 6600-5500 years B.P. Incision of the channel forming the T-0 terrace is thought to have begun around 1500 years B.P. Radiocarbon dates from T-0 deposits indicate that aggradation of the T-0 occurred as recently as 750 years B.P. and probably continued until historic times.

These two geomorphic surfaces correlate well with soil types in the valley. The Kennebec soils are associated with low, frequently flooded T-0 surfaces adjacent to stream channels in the Little Blue drainage basin. The Colo series also occur near stream channels, but they are at slightly higher elevations than the Kennebec soils. Colo soils are occasionally flooded. The Bremer soils occur at higher positions on the T-1 surfaces, and are further from stream channels than the Colo series. Zook and Wabash soils occupy broad backwater areas on the T-1 terrace; they frequently pond surface runoff due to poor drainage. Wiota soils

Wiota soils occur on the highest surfaces of the T-1 terrace and are well drained and rarely flooded. The upland soils include the Snead soil, located on hillside bedrock outcrops and weathered regoliths and the Sibley soil formed in upland loess on ridges and bluffs overlooking the Little Blue River.

The underlying bedrock of the Little Blue valley contains abundant lithic resources for use in the manufacture of chipped stone tools. The most commonly available chert occurs in blue-gray and tan varieties within the Winterset limestone which outcrops just above the Bethany Falls limestone. The uplands and hillslopes bordering the Little Blue River contain numerous locally concentrated chert outcrops in the form of weathered regoliths. Two other limestones, the Argentine and Westerville, outcrop near the study area and also contain chert. The nearest chert-bearing deposits of Westerville limestone are to the north in Clay County. Limited exposures of Argentine chert are present south of Longview Lake near the headwaters of the Little Blue River.

Paleobiotic and geomorphic evidence presented by Mandel (this volume) suggests that there have been major climatic changes in western Missouri. Principally, these involve shifts in the prairie-forest ecotone in response to the fluctuating climate. Pollen records indicate that an open pine parkland existed in the western Missouri Ozarks from ca. 34,000 to about 24,000 years B.P. The pine parkland was replaced by spruce forest as full glacial climatic conditions were established around 23,000 years ago. Spruce forest was present in western Missouri from this time until at least 13,500 years B.P. Spruce forest was replaced by deciduous forest with prairie elements sometime between ca. 15,000 and 11,340 years B.P. Beginning around 11,000 years B.P., post-glacial warming resulted in the spread of prairie eastward from the Central Plains into Missouri. Pollen and faunal data suggest that this trend peaked between 7000 and 6400 years B.P., although it probably continued for another millennia. This "prairie period" is referred to as the Hypsithermal - an episode of maximum Holocene aridity in the eastern Plains.

Geomorphic and paleobiotic evidence in western Missouri points to a complete recovery of arboreal vegetation with increased moisture around 3000 years B.P. Studies of pollen and land snail succession from areas along the southeastern margin of the Plains indicate that a biota similar to the present had been established by at least 2000 years B.P. There is no evidence for major bioclimatic change after ca. 1750 years B.P. in western Missouri.

A warm, dry Pacific climatic episode (ca. 950-450 years B.P.) has been postulated for the East-Central Plains. However, among late Holocene climatic episodes, the one that deviated most from modern conditions in the East-Central Plains apparently was the Neo-Boreal (ca. 400-130 years B.P.) or Little Ice Age. This was a moist and cool period that occurred between the anomalously warm Pacific (ca. 950-450 years B.P.) and Recent (130 years B.P.-present) climatic episodes. The Neo-Boreal climate should have been favorable for the expansion of forest onto prairie in the study area.

Evidence from land surveys indicates that at the time of Euro-American settlement, the oak-hickory forest in western Missouri was invading the grasslands. The oak-history forest of 140 years ago had encroached on the prairie-formed soils to a considerable extent, with the ecotone well within the limits of the prairie soils. This trend has apparently continued to the present, except for temporary reversals during drought years.

The underlying geological structure and the climate are the two major variables which maintain the grassland and deciduous forest biotic communities of the area. The vegetation of the Little Blue River area is transitional between the temperate grasslands to the north and west and the deciduous forest biomes to the southeast; this transition is characterized by extensive edge environments. Based on the 19th century General Land Office surveys and modern ecological studies, Brooks (this volume) has defined six major biotic communities for the area. These include the upland prairie, the slope-upland forest, the barrens, the floodplain forest, the lowland prairie and aquatic areas.

During the mid-19th century, the upland prairie zone made up approximately 24 percent of the area and contained faunal resources such as bison, wapiti and prairie chicken. Floral resources included tubers, shoots and seeds. The slope-upland forest, characterized by xeric-adapted plants on hillside slopes and upland divides, comprised 34 percent of the drainage area. Tree species were dominated by mast producing species, such as white and black oak, pin oak, walnut and hickory. Primary plant foods available in this community included fruits, berries, acorns, hickory nuts and walnuts. Major faunal resources included deer, squirrel, cottontail, raccoon and turkey.

The floodplain forest consisted of a narrow zone of woodland parallelling the Little Blue River. Extensive stands of floodplain forest also would have been present along the floodplain of the Missouri River. Typical tree species present in the floodplain forest include willow, elm, hackberry, walnut, maple, locust and sycamore. Shrubs included dogwood, coralberry, wild plum, gooseberry, black raspberry, blackberry and greenbriar. Floodplain plant foods included rhizomes, shoots, tubers, stems, seeds, fruit and nuts. Faunal resources included deer, turkey, squirrel, cottontail and raccoon. Lowland prairie areas were dominated by grasses such as big bluestem, prairie cordgrass and switchgrass. Large numbers of herbaceous plants, especially weedy seed producing species such as chenopods, amaranths and ragweed, were present in areas disturbed by siltation. Faunal resources included deer, bison, wapiti, cottontail and quail.

The aquatic community consisted of hydric-adapted plants in and along the main channel and abandoned oxbow lakes of the Little Blue River and along the Missouri River. Aquatic plant resources included shoots, tubers, leaves, and stems. Faunal resources include fish, mussels, turtles and frogs. Migratory waterfowl were also present on a seasonal basis.

THE CULTURAL SEQUENCE OF THE LITTLE BLUE VALLEY

Based on early survey work during the 1950s and 1960s by a number of local avocational archaeologists, such as W. R. Wilson, J. Mett Shippee and others, and later professional work in the 1970s, principally by Heffner (1974), Reid (1975) and Brown (1977), a total of 173 sites have been located in the Little Blue drainage. A large number of these sites have received only limited investigation and the cultural affiliation of 97 is either unknown or is so ambiguous as to be unreliable (Table 58). For the sites with identified components, the cultural affiliation in some instances can only be assigned to a general Archaic or Woodland stage. In most cases, however, the cultural affiliation can be broken down into specific Early, Middle or Late segments of the broader Archaic and Woodland stages.

As Table 58 indicates, three Paleo-Indian/Dalton, 26 Archaic, 50 Woodland, 14 Mississippian and 13 Historic Euroamerican components have been identified. The Archaic sites include two Early Archaic components, six Middle Archaic components and 15 Late Archaic components. The Woodland sites include four Early Woodland components, 25 Middle Woodland components and ten Late Woodland components. Superficially, these data suggest that the Little Blue valley was occupied from early Paleo-Indian times through the Historic period. However, only Middle Archaic through Mississippian period sites have been radiocarbon dated and studied in detail. The extensively studied sites which have been radiocarbon dated are listed in Table 59.

The cultural sequence, local phases and changes in projectile point styles for the Little Blue valley are shown in Figure 35. Early occupations in the Little Blue drainage basin are represented by only a few sites which are assigned to either the Paleo-Indian or Early Archaic periods on the basis of projectile point types. A Paleo-Indian component is represented by the recovery of a Plainview point from 23JA225 (Feagins 1976), however the assemblage from the site is an aggregate of several components and little can be said regarding the Paleo-Indian occupation. Two other early occupations are indicated by the recovery of Dalton points from sites 23JA160 and 23JA240. 23JA160 is located on the uplands overlooking the East Fork of the Little Blue River (Brown 1977, Peterson and Schmits 1982). 23JA240 is located on the upland interfluves between the Big Blue and Little Blue Rivers. Early Archaic occupations are indicated by the recovery of Graham Cave Notched projectile points from 23JA161 and 23JA181 (Peterson and Schmits 1982). Both of these sites are situated on upland bluffs overlooking either the Little Blue River or its tributaries. All of these early sites have received only limited investigation. Based on their location, size and generally limited artifactual content, they likely represent special purpose sites or short term residential occupations utilized by foragers engaged in exploiting upland resources.

Presumably, many early Paleo-Indian, Dalton and Early Archaic sites are deeply buried in floodplain alluvium, since a date of 8060 years

B.P. was recovered on wood charcoal located more than 7 meters below the surface in the T-1 terrace fill of the East Fork of the Little Blue River (Kopsick 1982). The recovery of this date from such a depth indicates that lowland surfaces could contain early sites which are deeply buried. This lack of lowland sites assigned to these early periods and the limited investigation of upland sites where pre-Middle Archaic occupations have been documented preclude a clear understanding of these early time at the present.

Table 58. Distribution of archaeological components in the Little Blue valley by terrain types.

	LOWLAND	SIDE SLOPES	UPLANDS	TOTAL	PERCENT
PALEO-INDIAN/DALTON	1		2	3	1.5
Early Archaic			2	2	1.0
Middle Archaic	4	1	1	6	2.9
Late Archaic	6		9	15	7.3
Archaic	2		1	3	1.5
TOTAL ARCHAIC	12	1	13	26	12.8
Early Woodland	4			4	1.9
Middle Woodland	19		6	25	12.3
Late Woodland	8		2	10	4.9
Woodland	7		4	11	5.4
TOTAL WOODLAND	38		12	50	24.5
MISSISSIPPIAN	11	2	1	14	6.7
UNKNOWN PREHISTORIC	54		44	98	48.0
HISTORIC EUROAMERICAN	2		11	13	6.4
TOTAL	118	3	83	204	99.9

Table 59. Radiocarbon dated components in the Little Blue valley.

SITE	COMPONENT	LABORATORY NUMBER	DATE B.P.	REFERENCE
23JA143	Middle Archaic	Beta-8535	6660±100	Schmits et al. (this volume)
		Beta-12001	6580±120	
23JA155 (Cold Clay)	Middle Archaic	Beta-8536	5590±120	Schmits (this volume)
		Beta-12000	5550±100	
		Beta-1325	4245±170	
		DIC-1678	4540±150	
		DIC-1679	4180±95	
23JA277	Middle Archaic	Beta-11684	5420±210	Baker et al. (1985)
23JA35 (Turner-Casey)	Late Archaic	Beta-1873	4550±115	Schmits and Wright (1982)
23JA110 (Sohn)	Late Archaic	DIC-913	2970±490	Reeder (1981)
23JA38 (Bowlin Bridge)	Early Woodland	Beta-1326	2440±90	Peterson (1982)
23JA159 (Traff)	Early Woodland	UGa-2404	2455±80	Wright (1980)
		UGa-2535	2345±70	
23JA36	Early Woodland	UGa-2535	2345±85	Ziegler (1981b)
23JA40	Early Woodland	UGa-2351	2300±100	Ziegler (1981a)

continued

Table 59 continued. Radiocarbon dated components in the Little Blue valley.

SITE	COMPONENT	LABORATORY NUMBER	DATE B.P.	REFERENCE
23JA110 (Sohn)	Middle Woodland	DIC-914 DIC-912 DIC-911	2220±195 1800±425 1720±75	Reeder (1978)
23JA238 (Black Belly)	Middle Woodland	Beta-8537 DIC-1680	1960±90 1620±45	Schmits (this volume)
23JA143	Middle Woodland	DIC-1683	1620±70	Schmits et al. (this volume)
23JA36	Middle Woodland	UGa-1874 UGa-1875	1520±170 1355±210	Ziegler (1981b)
23JA40	Middle Woodland	UGa-2350	1850±140	Ziegler (1981a)
23JA238 (Black Belly)	Late Woodland	Beta-12786 Beta-8538	1390±60 1310±60	Schmits (this volume)
23JA85 (Sperry)	Late Woodland	UGa-1869 UGa-1867 UGa-1868	1255±65 1220±70 1145±60	Brown (1981b)
23JA43 (May Brook)	Mississippian	DIC-1522 DIC-1526	780±90 730±130	Schmits (1982b)
23JA238 (Black Belly)	Mississippian	DIC-1603	680±65	Schmits (this volume)
23JA115 (Seven Acres)	Mississippian	UGa-2353 UGa-2352	705±55 615±65	Brown (1981a)

CULTURAL PERIODS, LOCAL PHASES AND DIAGNOSTIC POINT TYPES IN THE LITTLE BLUE VALLEY

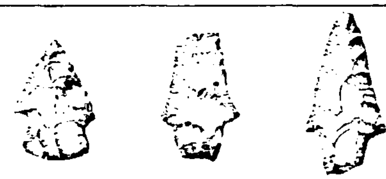
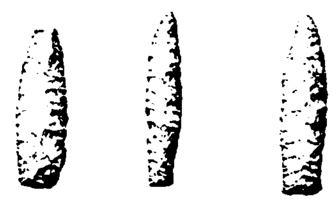
CULTURAL PERIOD	LOCAL PHASE	DIAGNOSTIC POINT TYPES
MISSISSIPPIAN 250-950 B.P. (1000-1700 A.D.)	MAY BROOK PHASE 600-900 B.P.	
LATE WOODLAND 950-1450 B.P. (500-1000 A.D.) — late	LAKE CITY PHASE 1100-1275 B.P.	
early	WOODS CHAPEL PHASE 1275-1400 B.P.	
MIDDLE WOODLAND 1450-2200 B.P. (250 B.C.-500 A.D.)	KANSAS CITY HOPEWELL AND OTHER POORLY KNOWN COMPLEXES 1600-2200 B.P.	
EARLY WOODLAND 2200-2800 B.P. (250-850 B.C.)	BOWLIN PHASE 2200-2550 B.P.	
LATE ARCHAIC 2800-4500 B.P. (850-2550 B.C.)	NEBO HILL PHASE 4500-3000 B.P.	
MIDDLE ARCHAIC 4500-7000 B.P. (2550-5050 B.C.) — late	JACOMO PHASE 5200-5700 B.P.	
early	BLUE SPRINGS PHASE 6450-6700 B.P.	
EARLY ARCHAIC, DALTON AND PALEO-INDIAN 7000-12,000 B.P. (5050-10,050 B.C.)	POORLY KNOWN EARLY COMPLEXES	

Figure 35. Cultural sequence, local phases and changes in projectile points in the Little Blue valley.

As a result of the 1983-1984 work at 23JA143 (Schmits et al.: this volume) and Cold Clay, 23JA155, (Schmits: this volume) more extensive data are available for the Middle Archaic period in the Little Blue valley. Middle Archaic burials have been recovered from 23JA277, which is also located in the Blue Springs Lake area (Baker et al. 1985). The Middle Archaic components at all three of these sites are deeply buried in floodplain alluvium, a factor which accounts for their lack of recognition during earlier surveys. In addition, Middle Archaic usage of the uplands is evidenced by the Coffin site, 23JA200 (Reeder 1977), and usage of valley slopes is evidenced by 23JA86 (Heffner and Martin 1976).

Based on the work at these five sites, the Middle Archaic period can be subdivided into two sequential units referred to as the Blue Springs and Jacomo phases. The early Middle Archaic Blue Springs phase includes the components at 23JA143 and Coffin. A Middle Archaic Blue Springs phase component also appears to be present at 23JA86 (Heffner and Martin 1976). The Blue Springs phase occupation at 23JA143 has been radiocarbon dated at 6580±120 to 6660±100 years B.P. and is characterized by small side-notched projectile points similar to those recovered from early Archaic sites in northeastern Nebraska (Kivett 1963), northwestern Iowa (Anderson 1980) and eastern Kansas (Schmits and Donohue 1984). The Blue Springs phase appears to have been part of an early Middle Archaic small side-notched point tradition that probably extended over most of the eastern Prairie Plains during the seventh millenia B.P.

The late Middle Archaic Jacomo phase is represented by the Cold Clay site (23JA155) and the burials at 23JA277. Evidence of a third possible component was encountered during lake construction at 23JA38. Acceptable radiocarbon dates from the Cold Clay site range from 5550-5590 years B.P. Diagnostic points from Cold Clay are medium to large-sized expanding stemmed and corner-notched forms, some of which are similar to points from Middle Archaic sites to the east in central and eastern Missouri and western Illinois (Reeder et al. 1983, Schmits and Bailey 1983, Cook 1976). Similarities are especially apparent with the late Middle Archaic Helton phase sites in western Illinois and eastern Missouri.

The Middle Archaic burials at 23JA277, located just downstream from 23JA155, date to 5420±210 years B.P. Analysis of the human remains (Baker et al. 1985) indicates the presence of three adults, including a male older than 55 years of age and two females older than 18 years of age. These interments were in a flexed position, possibly located in a pit.

The Late Archaic period in the Little Blue valley is represented by Nebo Hill phase sites. The Nebo Hill site (23CL11) is located on the bluffs of the Missouri River north of the Little Blue valley and has been dated at 3555 years B.P. (Reid 1983). In the Little Blue drainage, there are currently two radiocarbon dated Nebo Hill phase components. The Turner-Casey site (23JA35) has been dated at 4550±115 years B.P. (Schmits and Wright 1982) and the Sohn site (23JA110) has been dated at 2970±490 years B.P. (Reeder 1981). Although this latter date is

somewhat later than expected for Nebo Hill phase occupations, the point assemblage from the site is well within the range of variability for Nebo Hill points from Turner-Casey and Nebo Hill. A fourth site, 23JA170, is another important upland Nebo Hill phase site in the Little Blue valley (Jurney 1982c).

The Turner-Casey site and 23JA170 are large upland occupations which share many characteristics with the Nebo Hill site, including a preponderance of Nebo Hill points, bifacial hoes and fiber tempered ceramics. The Turner-Casey site currently represents the earliest date on an occupation containing fiber tempered ceramics in western Missouri.

Nebo Hill phase components are present at 12 other mostly small sites along the Little Blue drainage. However, the low frequencies of Nebo Hill points and the frequent presence of other temporally diagnostic forms complicates interpretation of many of these sites.

Brown (1981c) has posited the presence of a terminal Late Archaic Langtry complex in the Little Blue River valley, although sites representative of such a complex have not been investigated in detail. Presumably, the notion that such a complex exists originated with Martin's (1976) definition of a Langtry complex in his survey of the Fishing River drainage. Work at 23JA238 (Schmits: this volume) indicates that Langtry points are one of the principal types associated with the Middle Woodland occupation at that site. A Middle Woodland assemblage characterized by Langtry points has been located in the Osage drainage to the southeast of the Little Blue valley. It has been radiocarbon dated at 1900-1928 years B.P. (Wood 1976). In western Missouri and eastern Kansas, terminal Late Archaic sites are characterized by triangular corner-notched points (Grosser 1973, Schmits 1981, Parisi 1985). Since Langtry points are associated with Middle Woodland occupations in western Missouri and are not associated with terminal Late Archaic complexes, sites purportedly associated with the so-called Langtry complex in the Little Blue valley are likely nothing more than Middle Woodland occupations where ceramics are either not present or are few in number.

Prior to the mid-1970s, there was little evidence of Early Woodland occupation of the Little Blue valley. However, as a result of recent investigations, fairly substantial evidence of an Early Woodland complex in the area has emerged. Early Woodland components have been located at Traff, 23JA159 (Wright 1980), 23JA40 and 23JA36 (Ziegler 1981a, 1981b) and Bowlin Bridge, 23JA38, (Peterson 1982). All four of these sites are lowland occupations with radiocarbon dates from ranging from 2455 to 2300 years B.P. In addition, the McPherson site (23JA243), located immediately to the west on the Blue River drainage, has a well documented Early Woodland component with dates ranging from 2255$\pm$160 to 2325$\pm$160 years B.P. (Donham 1982). All five of these components are tentatively included within a proposed Early Woodland Bowlin phase.

The Early Woodland Bowlin phase is characterized by medium-sized subtriangular corner-notched points with a minor representation of Langtry contracting-stemmed points. Small quantities of sand or

possibly sand and hematite tempered ceramics have been recovered from Traff. The surface finish on these ceramics is badly eroded but may have been cordmarked (Wright 1980). While Wright (1980) has suggested that the Early Woodland ceramics at Traff may have some relationship to Illinois Valley Morton complex wares, Donham (1982) has pointed out that Morton complex ceramics post-date Early Woodland pottery in Illinois and commonly occur in early Middle Woodland contexts. Martin (1976) has noted the presence of cordmarked ceramics in the so-called "Langtry complex". The Early Woodland Bowlin phase with its cordmarked ceramic ware and minor representation of Langtry points may represent a Woodland base from which the more extensive indigenous Middle Woodland populations in the Little Blue valley later developed.

The Traff site is the only known Early Woodland Bowlin phase site along the Little Blue River that appears to have been occupied with a relatively high degree of intensity. It is also the only site where diagnostic artifacts are clearly associated with Early Woodland dates (Wright 1980). However, projectile points from 23JA40 and 23JA36 are comparable to those Traff, suggesting that these sites also represent Early Woodland Bowlin phase occupations. Although diagnostic artifacts were not recovered from the Early Woodland component at Bowlin Bridge, the radiocarbon dated of 2440±90 years B.P. is comparable to the dates from these other sites. All three of these latter sites appear to have been briefly occupied.

Middle Woodland components have been identified at a total of 15 sites in the Little Blue drainage although only four of these sites have been radiocarbon dated. The dated sites include Sohn, 23JA110, (Reeder 1978); 23JA36 (Ziegler 1981b); Black Belly, 23JA238, (Schmits: this volume) and 23JA143 (Peterson and Schmits 1982).

The Middle Woodland period in the Little Blue valley appears to be represented by several cultural complexes. One, principally represented by the occupation at Black Belly, is characterized by Langtry points and grit or sand tempered ceramics with a smoothed or cordmarked surface finish. This component has been dated at 1620±45 and 1960±90 years B.P. While there is considerable difference between these dates, both clearly fall within the Middle Woodland period. The Middle Woodland component at Black Belly does not appear to be related to the Kansas City Hopewell cultural complex, but is more likely representative of a poorly known indigenous Middle Woodland complex derived from an Early Woodland Bowlin phase base. The second type of Middle Woodland occupation is represented by occupations at 23JA84 and at Seven Acres site (23JA115). Both of these sites have Havana ware ceramics and are probably closely related to Kansas City Hopewellian populations to the north and west of the Little Blue valley.

A third Middle Woodland complex may be represented by the Woodland component at the Sohn site (Reeder 1978). This assemblage is characterized by subtriangular expanding stemmed points. Ceramics from the Sohn site are plain surfaced grit or sand tempered and have flared rims with decoration occurring only as impressions on the rims. Associated radiocarbon dates are slightly earlier than those from Black Belly ranging from 2220 to 1720 years B.P. Two rectangular structures

and a number of trash pits and hearths were associated with the Middle Woodland component at Sohn. Both structures contained interior and exterior post molds with the larger of the two covering a 17 sq m area. Reeder (1978) notes that the Sohn site ceramics better resemble late Middle Woodland or Late Woodland ceramics rather than classic Middle Woodland Hopewellian ceramics. Projectile points are variable including corner-notched and contracting-stemmed forms. Johnson (1983) has also recently suggested that the Woodland component at Sohn dates to the early Late Woodland period. Presumably, he feels that the radiocarbon dates are in error. However, the three dates from the site are consistent and fall in the Middle Woodland period. Therefore, there is no real basis for discounting them. Reid (1984) has also assigned the Woodland component at Sohn to the Early Woodland period on the basis of the earlier radiocarbon date of 2220 years B.P. obtained from the site.

A single radiocarbon date of 1620±70 years B.P. is available from the Middle Woodland component at 23JA143 indicating chronological placement in the Middle Woodland period. Unfortunately, no diagnostic artifacts other than plain surfaced grit or sand tempered body sherds were recovered from the site. The Middle Woodland component at 23JA36 has radiocarbon dates of 1520±170 and 1355±210 years B.P. These dates fall within the late Middle Woodland period and the site may be a transitional Middle Woodland to Late Woodland occupation. Diagnostic artifacts from 23JA36 include Langtry points, subtriangular Steuben points and punctate and cordmarked or plain surfaced grit tempered ceramics (Ziegler 1981b).

The projectile point assemblages from the non-Hopewellian Middle Woodland components are generally dominated by either contracting stemmed Langtry points or by subtriangular expanding stemmed points. The relatively few ceramics that have been recovered from these sites are mostly grit or sand tempered sherds with a cordmarked or smoothed surface finish. These sites differ from contemporaneous Kansas City Hopewell sites located on tributaries north of the Missouri River, such as Deister (Katz 1974), where large numbers of Havana Tradition ceramics have been recovered. As noted above, Havana ceramics have been recovered from only two sites in the Little Blue valley indicating minimal use of the area by Kansas City Hopewell populations. The Middle Woodland sites along the Little Blue River likely represent an indigenous development from the earlier Early Woodland Bowlin phase populations rather than ancillary camps associated with the Kansas City Hopewell sites as has been postulated by Brown (1981c). Unfortunately sufficient data are not presently available to characterize the cultural units represented by these sites.

Of the 10 identified Late Woodland components located along the Little Blue drainage, only the Sperry site (Brown 1981b) and Black Belly (Schmits: this volume) have been radiocarbon dated and intensively studied. Based on the data recovered from these two sites, the Late Woodland period along the Little Blue River can be subdivided into sequential units, referred to as an early Late Woodland Woods Chapel phase and a late Late Woodland Lake City phase. While both of these phases are represented in the Little Blue valley only by single intensively studied sites, the assemblages from these sites largely

conform to the characteristics of other early and late Late Woodland sites in the Kansas City area recently discussed by Johnson (1983).

The early Late Woodland Woods Chapel phase component at Black Belly (23JA238) has radiocarbon dates ranging from 1310 to 1390 years B.P. Diagnostic artifacts include plain surfaced ceramics tempered with fine sand, which occasionally have crenated lips and Steuben projectile points. Houses appear to be oval with interior hearths and pits. The early Late Woodland component at 23JA238 is comparable in most respects to other early Late Woodland sites in the Kansas City area, especially 14WY8, located near Edwardsville, Kansas (Johnson 1983). Other sites with early Late Woodland components in the Kansas City area include the Young site (23PL4), the Yeo site (23CL199) and 14MM26, which is located to the west in the Hillsdale Lake area of eastern Kansas.

While the data from these sites provides fairly substantial evidence for an early Late Woodland cultural unit in the Kansas City area that is primarily characterized by plain sand tempered ceramics, the dates associated with these occupations exhibit considerable variability. A radiocarbon date of 1340 ± 75 years B.P. from the Young site was associated with Late Woodland ceramics, and is comparable to the dates from Black Belly. Dates from Yeo are highly variable, ranging from 915-1850 years B.P. The available date from 14MM26 is 1160 ± 100 years B.P., which is somewhat later than the dates from Black Belly. Johnson (1983) interprets these early Late Woodland sites to be a terminal Kansas City Hopewell manifestation. However, there appears to be a sharp break between the early Late Woodland Woods Chapel phase and the earlier Middle Woodland sites in the Little Blue valley. A clear distinction can be seen in terms of both ceramics and projectile point styles. The Middle Woodland component at 23JA238 is characterized by thick smoothed and cordmarked ceramics tempered with coarse sand or grit and Langtry points, distinguishing it from the later Woods Chapel phase. Furthermore, there is evidence of clear stratigraphic separation between the Middle and Late Woodland components at 23JA238, indicating that two separate occupations are represented rather than a long continuous occupation, such as has been interpreted for the Young site. The square rectangular Middle Woodland houses at Sohn also contrast with the oval Late Woodland dwelling at Black Belly.

Radiocarbon dates from the Sperry site indicate that it was occupied considerably later than the Woods Chapel phase component at 23JA238. Ceramics from Sperry are predominantly plain surfaced, although a significant number are cordmarked (Brown 1981b). Both the plain and cordmarked sherds are principally tempered with crushed granite, although a smaller percentage are sand and sherd tempered. Projectile points from the Sperry site are small Scallorn-like arrow points. These artifacts are similar to those from sites included within the late Late Woodland period by Johnson (1983). The late Late Woodland occupation at Sperry has been designated as the Lake City phase.

The Mississippian period in the Kansas City area has been principally known by the Steed-Kisker phase sites centered on the Platte River drainage north of the Missouri River (O'Brien 1978a, 1978b). The presence of these sites in the Kansas City area is interpreted to have

resulted from migration by populations from the Cahokia area in the Mississippi valley. More recently, a second Mississippian period cultural unit, referred to as the May Brook phase, has been defined in the Kansas City area (Brown 1981a; Schmits 1980b, 1982b). Known May Brook phase sites are centered along the Little Blue valley. The best known sites include the Seven Acres site, 23JA115, (Brown 1981a), the May Brook site, 23JA43, (Schmits 1980b) and the Black Belly site, 23JA238, (Schmits: this volume). Recent work indicates that May Brook phase occupations are also located along the Big Blue River to the west (Feagins 1985; Parisi 1985). May Brook phase sites are characterized by artifact assemblages consisting of cordmarked and plain surfaced sherd and shell tempered ceramics and triangular notched and unnotched arrow points. Radiocarbon dates from these sites range from [illegible]0$\pm$90 to 615$\pm$65 years B.P. indicating a chronological position centering in the 13th century A.D.

In addition to these intensively studied sites, May Brook phase components are also evidenced at other sites in the Little Blue drainage. Cordmarked shell tempered and plain sherd tempered ceramics along with a small arrow point were recovered from Bike Track Shelter, 23JA9, (Peterson and Schmits 1982). A May Brook phase component was also present at the Bowlin Bridge site, 23JA38 (Peterson 1982). While the May Brook phase sites fall within the Mississippian period, their closest relationship appears to be with Plains Village populations to the west, especially the Plains Village Pomona focus (Schmits 1982b).

SETTLEMENT-SUBSISTENCE PATTERNS

The following discussion of prehistoric settlement and subsistence patterns in the Little Blue begins with the Middle Archaic period, since relatively little data are available for earlier periods and continues through the Mississippian period May Brook phase.

Middle Archaic

As discussed above, the six known Middle Archaic components are representative of two distinct phases. The early Middle Archaic Blue Springs phase is mainly known on the basis of the data recovered from 23JA143, although important information is also available from the Coffin site (23JA200) and 23JA86. The Blue Springs phase subsistence patterns at 23JA143 appear to have been focused on woodland and edge environments with primary emphasis on white-tailed deer, although the presence of bison and gray wolf indicates use of upland prairie-adapted species as well. A minimum of nine white-tailed deer were recovered from 23JA143 (Schmits et al.: this volume). Analysis of the frequency of occurrence of various elements indicates that the deer were butchered and processed at the site. The single bison individual represented was probably butchered elsewhere and the more manageable portions brought back to the site. Utilization of slope and lowland floral resources, particularly hickory nuts and black walnuts and, to a lesser degree,

starchy plant species, such as chenopods, ammania, portulaca and purslane is also evident. The age distribution of the deer and the restricted periods of availability for the floral remains indicate that 23JA143 was occupied during the late summer or fall.

The Coffin site is located on an upland ridge crest that was most likely covered by upland prairie at the time of its occupation (Reeder 1977). No organic remains were recovered from the site; however, a fairly restricted number of activities were carried out, based upon the tool categories that were present, including hunting, tool manufacture, hide processing and butchering tasks. There was no indication that plant food processing took place at the site. Reeder (1977) suggests that the site functioned as a temporary campsite that was occupied during the warmer late summer and early fall months. No subsistence related data is available from the Middle Archaic occupation at 23JA86.

Inferences regarding the full range of Blue Springs phase settlement patterns are incomplete as only 23JA143 and Coffin have been studied in detail. Both appear to have been occupied during the mid or late summer through fall. No season of occupation can be assigned to 23JA86. However, there are significant differences in the topographic setting of these two sites. Coffin appears to have been an upland special purpose or extractive camp occupied for a fairly short period. 23JA86 likely represents a more ephemeral limited use campsite. 23JA143 was a much more intensively used lowland residential site that was probably occupied over a longer period. Five hearths and five chert knapping stations were located at the site and spatial analysis indicates that at least four activity areas surrounded or were adjacent to the hearths and knapping stations. These areas may represent individual family areas. The chert produced at the knapping stations was initially procured from off-site locales and then brought back to 23JA143 for further processing.

The distribution of Blue Springs phase sites indicates that lowland floodplain, valley margin and upland settings were utilized as site locations. There is substantial evidence that 23JA143, a lowland floodplain site, was occupied as either a residential base or extractive camp during the warm season. The Coffin site appears to have functioned as an upland warm season extractive loci. The occupation at 23JA86 is located on a bluff slope. The presence of an intensively occupied warm season lowland site appears to distinguish the Blue Springs phase settlement pattern from the later more extensive Nebo Hill phase settlement pattern, as characterized by Reid (1983). Reid suggested that the Nebo Hill pattern consisted of warm weather upland group aggregation and cold weather dispersal to sheltered lowland sites. The data for the Blue Springs phase indicates a more diffuse pattern with more varied site location, perhaps in response to the drier climatic conditions of that time. The ridge-top location of the Coffin site would have provided an ideal location from which to hunt the bison, which could then have been transported in smaller portions to the residential bases, such as 23JA143. Other specialized tasks, gathering, perhaps, could have taken place at 23JA86.

The presence of at least two functionally different types of Blue

Springs phase sites in different topographic settings and occupied at least in part during the same seasons could indicate either a foraging or collecting adaptation (Binford 1980). Either of these forms of adaptation would include residential sites from which smaller groups split off to exploit more specialized resources. Further data from other sites will be needed to document the full range of the Blue Springs phase settlement-subsistence patterns.

The late Middle Archaic Jacomo phase is primarily defined on the basis of the data from the Cold Clay site (23JA155) and from 23JA277. Cold Clay is a lowland site located near the headwaters of the East Fork of the Little Blue River which evidences a more limited range of subsistence activities as compared to the earlier lowland occupation at 23JA143. No features were located at Cold Clay, although the charcoal obtained for radiocarbon dating likely represents ashes from nearby hearths. No specialized activity areas were discernible at 23JA155, although this may result from factors such as post-occupational disturbance or the limited area of the site excavated. The analysis of tool types and use-wear patterns indicated that the occupants of this relatively small campsite focused on lithic tool manufacture, pigment processing and tasks requiring scraping and perhaps hide-working tools. The final stages of lithic reduction took place at the site with procurement occurring elsewhere. The absence of discrete activity areas indicates the more limited nature of the Middle Archaic occupation at Cold Clay. No cultural materials were found in association with the burials recovered from 23JA277 (Baker et al. 1985). The three adults buried there were apparently part of a small social group.

Jacomo phase subsistence patterns appear to have been focused on a narrow range of resources, primarily deer and nuts. The presence of a few ground stone tools at 23JA155, such as a mano and metate, indicates at least minimal usage of floral resources during the late Middle Archaic. Subsistence at Cold Clay appears to have been focused on forest and forest-edge environments. There is no evidence of the exploitation of prairie or aquatic species, although the organic remains do suggest an emphasis on lowland resources.

It is difficult to postulate a settlement pattern for the Jacomo phase on the basis of the limited data recovered so far. At present, only a small residential extractive camp, which was probably occupied during the warm season, and a mortuary site have been located. Both sites are buried in the T-1 terrace of the Little Blue River. The Jacomo phase appears to represent an adaptation to the lowlands environment of the Little Blue River with lesser emphasis on the upland locales that were utilized during the subsequent Late Archaic period.

Late Archaic

Prior to the current investigations in the Little Blue drainage, the only model of Archaic settlement patterns in the Kansas City area was that proposed by Reid (1980b, 1983, 1987) and Reeder (1980, 1981) for the Nebo Hill phase. Reid's model is based primarily on physiographic and meteorological considerations or "limiting factors"

and postulates warm-weather group aggregation at upland sites and cold weather dispersal to sheltered lowlands. Reid suggests that the Nebo Hill economy was based on faunal and floral resources of the Missouri floodplain, the tributary valleys, and slopes and summits of the adjoining uplands. The upland warm weather phase is hypothesized to have been focused on the fall nut and deer harvest.

Reeder (1980) proposed a similar settlement pattern for the Nebo Hill phase, consisting of warm weather usage of the uplands and winter use of the lowlands. He cites exposure to harsh weather, a decrease in the amount of available water and a decline in upland deer populations as factors which may have made it difficult to support large groups of people in the uplands during winter. He suggests that occupation of the lowland areas would be more advantageous during the winter and that the duration of winter occupations may have been shorter as a result of frequent movements. Such a pattern would have allowed for exploitation of large sections of the lowland environment.

Brown (1981c) has also suggested that Nebo Hill phase settlement patterns in the Little Blue valley involved winter encampments by smaller social groups in the lowlands and larger warm weather occupations in the uplands. Brown places the Sohn site, 23JA104 and 23JA112 in the former category and 23JA170 in the latter site type. More recent work at 23JA104 and 23JA112 (Jurney 1982b, 1982d) indicates that there is minimal or no evidence of a Nebo Hill occupation at these two sites.

If the Reid-Reeder model is correct, the Nebo Hill sites along the Little Blue River that were recently investigated, such as Turner-Casey (Schmits and Wright 1982) and 23JA170 (Jurney 1982c) represent warm weather occupations by a sizeable group of people, perhaps a number of kin groups. There is, however, meager direct substantive data with which to test this hypothesis as limited faunal and floral remains have been recovered from these sites. For example, the hickory nut, acorns, walnuts and grape seed recovered from Turner-Casey would be available principally from September through October, suggesting occupation during this period. However, these data do not preclude occupation of Turner-Casey during the spring and summer, later during the winter, or even on a year round basis.

Reid considers the high density of material and large size of the Nebo Hill site (23CL11) to indicate repeated seasonal use of the same area over a long period of time. While evidence of midden stains is not present at either Turner-Casey or 23JA170, concentrated lithic deposits are present at both sites. These concentrated deposits could result from repeated use of these same areas on a seasonal basis, or they could also result from long-term semi-sedentary occupation of the sites for a fewer number of years.

The major activities that took place at the Nebo Hill site include hunting, plant food processing, digging, chipped stone tool manufacture, woodworking and mineral working (Reid 1980b). Subsistence-related activities at Turner-Casey are comparable to those at Nebo Hill (Schmits and Wright 1982). Other similarities between Nebo Hill and Turner-Casey

include the large areal extent of habitation debris and the upland topographic setting. However, there are discrepancies between specific tool frequencies at Turner-Casey and Nebo Hill particularly among ground stone tools. Nebo Hill has a higher frequency of these implements, particularly manos, metates, abraders and axes made from local Clay County glacial erratics. While this difference may be due to the differential availability of these raw materials, it may also result from differential exploitation of food resources.

The assemblage from 23JA170 is characterized by a large number of light and heavy-duty cutting and scraping tools, lithic manufacturing debris and a small number of ground stone manos and metates. Preservation of organic material is extremely poor and no cultural features were located. Although 23JA170 is on a blufftop, it is not as large as either Turner-Casey or Nebo Hill. However, the large amount of lithic debris and tools present indicate intensive occupation of the site.

The assemblage from the lowland Nebo Hill occupation at the Sohn site is comparable with Nebo Hill, Turner-Casey and 23JA170 in terms of subsistence-related activities. However, there are differences in relative frequencies of tool types. Although Sohn is considered to be a small, cold weather occupation, the percentage of heavy-duty cutting and scraping tools is greater than that found at Turner-Casey. The number of manos at Sohn is equal to the number found at Nebo Hill.

The inhabitants of Turner-Casey utilized forest and forest-edge species, such as a white-tailed deer, hickory nuts, walnuts and grapes (Schmits and Wright 1982). The occupants of Nebo Hill, on the other hand, also exploited the riverine environment of the Missouri River, as fish, ducks and turtles were present in the assemblage from the site. In addition to the expected emphasis on white-tailed deer, nuts and starchy seed producing species were also exploited at Nebo Hill (Reid 1980b, 1983). Evidence of significant levels of exploitation of grassland or prairie environments is missing from both sites. The occupants of Sohn appear to have focused more narrowly on forest resources, such as deer and nuts. There is little evidence of the exploitation of the variety of food resources at Sohn that were utilized at the other three sites.

As discussed above, Reid (1980b, 1983, 1984) and Reeder (1980) suggest a topographic and seasonal dichotomy for Nebo Hill phase habitation sites. Large sites, presumably base camps, were established on blufftops during warm weather to facilitate large communal harvests. Smaller encampments were established in the tributary stream valleys during the winter in order to escape the harsh, cold weather conditions and to ameliorate the effects of diminished resources during the winter. Late Archaic site locations in the Little Blue valley are evenly spread across the main terrain types present in the area (Table 58). Of the 18 Late Archaic components located, nine are situated on lowland terrain, including the Sohn site, and nine are on upland soils which are generally either loess derived or bedrock derived soils. Turner-Casey and 23JA170 are among those sites situated on upland loess soils.

Certainly, Nebo Hill populations utilized upland site locations during the warm seasons. However, it is not clear whether all of these upland sites functioned in similar capacities within the Nebo Hill settlement pattern as postulated by Reid, or whether some of these sites may have consisted of semi-sedentary base camps occupied over a longer period of time. Turner-Casey is located off of the Missouri mainstem on the uplands overlooking a tributary, the Little Blue. In Archaic contexts to the east, Late Archaic settlement patterns show an increasing emphasis on mainstem base camps with outlying extractive loci serving to logistically access specific resources (Emerson et al. 1986). While the Nebo Hill settlement pattern shows significant difference from the American Bottoms patterns, the distinction between mainstem and tributary site locations is not easily addressed under Reid's model. The range of Nebo Hill site types appears to be more complex, including base locales located on uplands overlooking large rivers, residential sites located on uplands overlooking tributaries and residential extractive camps on tributary terraces.

Early Woodland

There are currently four radiocarbon dated Early Woodland occupations in the Little Blue River valley. All four are lowland Bowlin phase occupations. Two of the sites, 23JA36 and Bowlin Bridge, have been characterized as small camps occupied on a temporary basis (Ziegler 1981b; Peterson 1982). The occupation at 23JA40 appears to have been somewhat more extensive than the occupations at 23JA36 or Bowlin Bridge. In addition, the McPherson site (23JA243), situated to the west on the Blue River, also was occupied with a fairly high degree of intensity (Donham 1982).

A range of activities occurred at all four sites, including lithic tool production and food preparation tasks. Based on features, tool types and floral and faunal remains, 23JA36 appears to have been occupied during the late summer and fall (Ziegler 1981b), Traff was probably occupied during the summer, fall and possibly during the winter (Wright 1980), and 23JA40 was likely occupied during the summer through late fall (Ziegler 1981a). Evidence of season of occupation for the Early Woodland component is not available for Bowlin Bridge. The McPherson site was probably occupied during the fall (Donham 1982).

23JA36, Bowlin Bridge and McPherson all appear to be briefly occupied hunting camps or extractive loci. The Traff occupants carried out domestic activities with a fairly high degree of intensity, although no features other than two possible hearths were located (Wright 1980). The Bowlin phase occupation at 23JA40 appears to be more intensive than the three hunting camps, although not as intensive as Traff.

The site location data indicates that the Early Woodland Bowlin phase sites are all situated in lowland settings, primarily on T-1 terrace Bremer soils. No upland Early Woodland sites have been located in the Little Blue valley. It would be expected that, given the extensive Late Archaic Nebo Hill usage of upland sites in the Kansas City area, continued usage of the uplands by Early Woodland populations

in the area would also have occurred. However, at the present time, no such sites have been identified and the Early Woodland Bowlin phase appears to represent a shift in settlement patterns back towards the emphasis on lowland environments seen during the Middle Archaic period. The Bowlin phase population in the Little Blue valley utilized a variety of lowland locales during the warm season months for both residential purposes and more specialized tasks, such as hunting. The onset of the cold months may have seen a consolidation into residential sites, such as Traff, or a dispersal to as yet unidentified other sites.

Evidence of Early Woodland subsistence patterns is available from three of the sites. Both faunal and floral resources were utilized at 23JA36, 23JA40 and Traff with relatively extensive use of herbaceous floral resources including starchy seed producing species, such as chenopods, amaranths, and purslane at both 23JA40 (Ziegler 1981a) and Traff (Adair 1980). Hickory nuts were also recovered from 23JA36, McPherson and Traff, while a large number of black walnuts were also recovered from McPherson (Donham 1982).

Early Woodland Bowlin phase subsistence patterns in the Little Blue valley were focused on forest and forest-edge faunal resources, particularly deer. However, there seems to have been a reliance on some of the smaller species such as raccoon, beaver and turtle, which were also present in these environments. The inhabitants at Traff also exploited the prairie environments, as bison remains were recovered. The floral remains indicate exploitation of forest-edge and lowland disturbed locales, as well as the mast resources present in riparian and slope forests.

Middle Woodland Period

The Middle Woodland period was the most thoroughly investigated period in the Kansas City locality prior to the mid-1970s. Most of this work had focused on Kansas City Hopewell sites located primarily in Platte and Clay counties north of the Missouri River. Johnson (1976) describes the Kansas City Hopewell settlement pattern as consisting of large villages located on tributaries of the Missouri River where these smaller streams break from the bluff line to enter the Missouri floodplain. Small ancillary camps were located upstream in tributary valleys. The smaller upstream camps exhibit similarities in ceramic styles and have a limited range of artifact types and inferred activities relative to the larger villages located downstream. It was suggested that the smaller upstream camps had an ancillary and special purpose relationship with the larger villages, in that the former were established as a response to population increases and the need to expand hunting and gathering territories (Johnson 1976:8-15). The Middle Woodland economy was focused on exploitation of the Missouri River floodplain forest and prairie, tributary forests, slope and upland oak-hickory forests and the upland prairie.

An alternative model of Kansas City Hopewell settlement patterns has been proposed by Reid (1980a) who argues that the establishment of large permanent villages near the floodplain was not a response to the

subsistence-related advantages of that environment. He states that although the floodplain of the Missouri River would offer tracts of land suitable for horticulture, there is no evidence for dietary reliance on these domestic products, nor are there indications that increased dependence on fish or waterfowl are correlated with the establishment of these villages. He suggests that the distribution of large settlements influenced by social and economic factors involving the manipulation of people and goods by means of riverine modes (Reid 1980a:37-42). He suggests that the riverine orientation of the smaller ancillary camps is better explained in terms of logistics rather than subsistence variables (Reid 1980a:41).

The Middle Woodland Kansas City Hopewell settlement pattern models put forth by Johnson and Reid can be evaluated in part by the data recovered along the Little Blue drainage. The Middle Woodland occupations in the Little Blue Valley are largely small sites located on alluvial terraces with little evidence of intensive occupation.

Specific information regarding Middle Woodland settlement patterns, such as duration and season of occupation, is limited. This is partly a result of the limited information recovered from many of the sites. Consequently, most of the available information concerning the Middle Woodland comes from 23JA112, Sohn and Black Belly.

It appears that Middle Woodland sites in the Little Blue valley consist of small, short-term occupations principally located on the T-1 terrace of the Little Blue River. Organic remains from two of the sites, Black Belly (23JA238) and 23JA112, indicate utilization of both forest and aquatic lowland environments. Deer, fish, mussels, acorns and hickory nuts represent the major food resources exploited by the Middle Woodland inhabitants of these sites. Non-mast floral resources, such as ammania, may also have been used. Based on these remains, occupation at these two sites occured during the summer and fall seasons.

The site distribution data presented in Table 58 indicate the predominance of lowland locations during the Middle Woodland period in the Little Blue valley. Of the 25 known Middle Woodland components, 19 are situated on either floodplains or terrace soils, including Black Belly, Sohn and 23JA112, while only six are situated on upland terrain.

The Middle Woodland sites could represent a variety of seasonal postures or they could represent late summer and fall extractive loci associated with more intensively occupied villages outside the drainage. No intensively occupied permanent villages are known to be present along the Little Blue River. The relationship of these sites to other Middle Woodland sites north of the Missouri River is also ambiguous. The Little Blue sites could represent ancillary sites associated with more permanent and unknown villages located near the Missouri River or on adjacent drainages. However, as we have noted, Middle Woodland sites along the Little Blue River have typological characteristics which distinguish them from Kansas City Hopewell sites. Consequently, these occupations probably represent a distinct Middle Woodland cultural tradition in the Little Blue valley. This cultural system may have

evolved from earlier local Early Woodland social groups that have a considerably less complex social organization than the Kansas City Hopewell Middle Woodland tradition. If this is the case, the dispersed short-term Middle Woodland settlements along the Little Blue may represent the full range of settlement types and seasonal postures associated with this culture.

Late Woodland

The Late Woodland period in the Little Blue drainage is represented primarily by the Woods Chapel phase at Black Belly (23JA238) and the Lake City phase at the Sperry site (23JA85). Both are lowland residential occupations. However, while Sperry was probably occupied as a residential extractive camp by a small social group during the summer to fall and/or winter (Brown 1981c), Black Belly was probably occupied, as a base locale over a longer period of time, perhaps several seasons, or for a year or more (Schmits: this volume). The presence of a house with an interior hearth and pits indicates the intensity and duration of the site's usage. In terms of site function, the occupation at Black Belly has characteristics that are closer to those of a base camp rather than to a residential camp. A broad range of tools, debris and features was present, including an oval-shaped habitational structure. While such a site type might be seen as a continuation of Hopewellian Middle Woodland patterns (Johnson 1983), typological differences, discussed above, and the more permanent nature of the occupation differentiate the Woods Chapel phase component at Black Belly from the model proposed by Johnson (1983). The early late Woodland component at 23JA238 represents a long-term multi-season or semi-sedentary occupation rather than a seasonally occupied campsite.

The Lake City phase occupation at Sperry appears to be a seasonal short-term occupation which likely occurred in the summer, fall or winter. Subsistence at Sperry was focused on a fairly wide and diverse range of resources from prairie forest and edge environments, including elk, white-tailed deer, turkey, cottontail, vole, turtle and raccoon. Additionally, the Black Belly inhabitants utilized extensively the hickory nuts available from the adjacent riparian and slope forests, as well as the walnuts and acorns also available there. Similarly, the Sperry occupants exploited fauna from forest and forest-edge environments and flora from a wide range of edge and disturbed contexts.

The distribution of Late Woodland sites in the Little Blue valley indicates a continuation of the Early and Middle Woodland preference for lowland site locations with eight of ten known components situated on floodplain or terrace terrain (Table 58). Both Black Belly and Sperry are located on these lowland terrain ty .

Overall, the pattern indicated by these Late Woodland sites indicates the exploitation of an increasingly diversified and broad resource base during the Late Woodland period. This pattern made the widest use of resources by any of the populations which had used the Little Blue valley up to that time. There is also evidence for an increasing complexity in site type during the early Late Woodland,

including the construction of houses and the more extensive use of storage pits.

May Brook Phase

As we have noted, several sites investigated in the course of the Little Blue Lakes project have May Brook phase components. Included are the Seven Acres site, 23JA115, (Brown 1981b), the May Brook site (23JA43) (Schmits 1982b) the Black Belly site (Schmits: this volume), Bowlin Bridge, 23JA38, (Peterson 1982) and Bike Track Shelter, 23JA9, (Peterson and Schmits 1982).

The May Brook phase component at the May Brook site consists of a concentrated cultural stratum buried in T-0 alluvium. The lithic assemblage indicates that the site represents a residential extractive camp focused on the manufacture and use of chipped stone tools for hunting, butchering and hide preparation. Faunal remains indicate that subsistence was based on white-tailed deer. Bison and a number of small mammals such as raccoon, woodchuck and cottontail were of lesser importance. Floral remains indicate the intensive harvesting of the seeds of wild annual herbaceous plants such as amaranths, ammania, chenopods and purslane. Mast resources, such as acorns and hickory nuts, were also utilized extensively. Other plant resources, such as smartweed, pondweed, dewberry, grapes, greenbriar, coneflower and black walnut, may have been exploited to a lesser extent. The restricted periods of availability for a large number of floral resources as well as other types of data indicate that May Brook was occupied during the late summer or fall.

Seven Acres is located on the floodplain of the Little Blue River. A large block excavation opened at Seven Acres resulted in the recovery of features, ceramics, lithics and faunal and floral remains (Brown 1981b). Features included a basin-shaped hearth and a small trash-filled storage pit. The faunal inventory is nearly identical to that recovered from May Brook, both in terms of the species present and the number of individuals of each species represented. For example, five deer and one bison are represented at each site, while two raccoon are present at May Brook and one at Seven Acres.

The floral assemblage from Seven Acres includes nuts from five species of trees and 34 taxa of carbonized seeds (Brown 1981b). As at the May Brook site three species of nuts, hickory, black walnut and oak, account for nearly all of the nut remains. Brown suggests that the major plant resource exploited by the occupants of Seven Acres was mast resources. Based primarily on the carbonized nuts and seeds, Brown suggests that Seven Acres was occupied during the late summer or early fall. Evidence of cultigens at Seven Acres is limited to two fragments of corn (*Zea mays*). No evidence of squash (*Cucurbita*) or beans (*Phaseolus*) was encountered. A mano was also recovered and suggests that the processing of seeds may have occurred at the site. Five species of carbonized seeds have high frequencies of occurrence: pennycress, pink, foxtail, purslane and bedstraw. Species which were such as amaranths and chenopods are also present in small numbers at

Seven Acres. It is highly probable that some of these species were utilized.

The May Brook phase occupations at Black Belly (23JA238) and Bowlin Bridge (23JA38) appear to be similar to those at Seven Acres and May Brook. They are located in lowland depressional areas and would be suitable for habitation during periods of low rainfall, such as late summer, fall and possibly winter. Faunal and floral remains from Bowlin Bridge indicate the exploitation of bison and wild seeds such as ammannia, chenopods and purslane (Peterson 1982). Organic remains from Black Belly are limited, although white-tailed deer, ammannia, purslane, greenbriar seeds and hickory nuts are represented.

Bike Track Shelter represents another type of May Brook phase site type (Peterson and Schmits 1982). Faunal remains from Bike Track Shelter include deer, small mammals and birds. Floral remains include a single hickory nut and walnut shells. While the sample of faunal and flora remains from the shelter is limited and association of these materials with the May Brook phase component is uncertain, it is likely that the site represents a hunting camp occupied for a brief duration by a small social group.

Based on the excavations at Seven Acres, May Brook, Black Belly, Bowlin Bridge and Bike Track Shelter, the May Brook phase is characterized by sites consisting of short-term, seasonally occupied residential extractive camps principally located on low-lying Kennebec soils of the T-0 floodplain of the Little Blue River and its tributaries. Tool manufacture and extractive tasks, such as deer hunting and processing and wild seed procurement, were the major activities which took place at these sites. The sites lack evidence of architectural features typical of more permanent base locales. Because of their location on the flood plain and vulnerability to inundation during the wet season, they would not have been suitable for use on a year round basis.

One conspicuous feature of the May Brook phase sites is the lack of tropical cultigens. Despite the extensive flotation of matrix samples, only minimal evidence of tropical cultigens has been recovered from two of the sites, Seven Acres and Bowlin Bridge, while no evidence of these species was recovered from the other May Brook phase sites.

The site distributional data in Table 58 indicates a continuation of the predominance of lowland site location noted during the Woodland period in the Little Blue River valley. Of the 14 known Mississippian components, 11 are situated on terrace or floodplain terrain, two on side-slopes and one is located on upland terrain. Seven Acres, May Brook, Black Belly and Bowlin Bridge are all situated on lowland terrain. Bike Track Shelter and 23JA125 are located on the side slopes and 23JA133 is on upland terrain.

The hunter-gatherer settlement-subsistence pattern of the May Brook phase contrasts with what is generally known about the Mississippian period. More permanent villages or hamlets with fairly substantial architectural remains and a subsistence pattern involving horticulture

would have been expected. The May Brook phase sites likely represent ancillary extractive sites associated with more permanent settlements. A likely location for such base locales would be the higher Bremmer soils on the T-1 terraces of the Little Blue River and its tributaries. To date, there is little evidence to indicate that such sites exist in the Little Blue valley. However, recent evidence of a May Brook phase structure has been located at the Vaughn Estes site along the Big Blue drainage to the west of the Little Blue drainage (Parisi 1985). Sites with Plains Village like characteristics have also been located along the Fishing River (Martin 1976). It is probable that more intensively occupied May Brook phase base camp were located outside the Little Blue drainage.

LITHIC RESOURCE UTILIZATION

It has generally been assumed that the procurement of chert involved a direct set of strategies utilized for the expressed and exclusive purpose of obtaining lithic raw materials. Binford (1979) has criticized this traditional interpretation, especially the assumption that the presence of exotic lithic materials in an archaeological site indicates evidence of a trip made to the source of that material. Rather, he suggests that the lithic procurement strategies are embedded within some other subsistence strategy. From this perspective, the presence of exotic or nonlocal cherts becomes a measure of the mobility of the cultural system. Following Binford, Reid (1980) has also noted that the logistics of settlement-subsistence patterns are reflected in the range of lithic raw materials at sites. He suggests that residential sites would evidence highly homogeneous raw material types derived from immediately available cherts, while heterogeneous assemblages would map extended territories exploited by more mobile populations.

The three chert-bearing limestones in the vicinity of the Little Blue River valley are derived from the Winterset, Westerville and Argentine limestone formations. Of these, the Winterset is the most locally abundant and easiest to locate due to its stratigraphic position just above the conspicuous outcropping of Bethany Falls limestone. The chert is of generally good quality and occurs in bedrock, weathered regoliths and secondary alluvial deposits throughout the valley. Winterset occurs in massive blue tabular layers and brown tabular chunks and nodules. Brown Winterset is usually located lower section of the Winterset formation and more frequently outcrops to the south in the Longview Lake area. Brown Winterset has a smooth, lustrous appearance and a mottled to homogeneous internal structure. Blue Winterset chert is located in the upper portions of the formation in both lake areas. Blue Winterset is often riddled with calcite veins and laminae.

Argentine chert does occur in minor frequencies especially toward the headwaters of the Little Blue east of Grandview. However, the results of Kopsick's (1982) work indicate that Westerville chert is not present in the Little Blue drainage. The tan variety of Winterset chert

has been only recently identified by Kopsick (1982). Prior to this, it has been assumed that Winterset chert was primarily restricted to the typically blue or gray varieties. Brown Winterset is similar to Westerville chert from Clay County, Missouri. Because of this and the fact that no chert-bearing Westerville limestone occurs in the study area, brown Winterset cherts appear to have often been confused with imported Westerville chert. On the basis of test excavations at 23JA170 Brown (1976) reported that Westerville chert accounted for 52 percent of the chipped stone debitage and 60 percent of the point samples. However, the 1979 excavations at 23JA170 (Jurney 1982c) indicated that only 29 percent of the points were Westerville chert. The overwhelming majority of points and other tool classes and debitage are Winterset chert. At the Sohn site (23JA110) Reeder (1977) reported that 44.7 per cent of the Late Archaic points were Westerville and Argentine chert. Reanalysis of this sample by Reid (1980b) indicated that only 30 percent of this sample was non-local which he identified as a mixture of Westerville and Spring Hill cherts.

The distribution of chert types and the frequency of heat treatment for projectile points from thirteen of the more intensively studied sites in the Little Blue valley is presented in Table 60. As suggested by the discussion above, these data should be viewed with a certain amount of caution as the cherts were identified by a number of different researchers over a considerable period of time. Information regarding identification of the chert types is better now than it was when some of the earlier studies were conducted. Nevertheless, we suspect that the broad patterns indicated by the data presented in Table 60 in fact are valid.

The tabulations in Table 60 indicate the predominant use of Winterset chert throughout prehistoric occupation of the area. As the most abundant locally available chert this is perhaps to be expected. There is an increased usage of non-local cherts, especially Westerville chert, at the Late Archaic Nebo Hill sites. The use of non-local Westerville chert at these Nebo Hill sites probably reflects a higher level of residential mobility for Nebo Hill groups. Non-local white cherts, presumably Burlington chert from central or south-central Missouri, also occur at Late Archaic sites, but are most common in Late Woodland and Mississippian period May Brook phase sites. Unidentified non-local cherts are most common in the late Middle Archaic component at 23JA155 and the Early Woodland component at 23JA159.

In general then, the distribution of chert types in point assemblages from sites in the Little Blue valley indicates a predominant reliance on the use of local Winterset cherts. Considerable use was made of Westerville chert procured from north of the Missouri River at Late Archaic sites suggesting use of this area by Little Blue valley Nebo Hill populations. There is also considerable use of white Mississippian cherts at Late Woodland and Mississippian period May Brook phase sites indicating use of areas to the east or southeast by these later populations. An alternative interpretation, of course, would be that the presence of these non-local cherts implies the presence of trade relations to the north during the Late Archaic period and to the east and southeast during the Late Woodland and Mississippian periods.

Table 60. Chert type and percentage of heat treatment for projectile points from sites in the Little Blue River valley.

SITE	REFERENCE	SAMPLE SIZE	CHERT TYPE (PERCENT) WINTER-SET	WESTER-VILLE	ARGEN-TINE	UNKNOWN NON-LOCAL	NON-LOCAL WHITE	HEATED (PERCENT)
Middle Archaic								
23JA143	Schmits:this volume	10	100.0					0
23JA155	Schmits:this volume	12	66.7			33.3		41.7
Late Archaic								
23JA35	Schmits & Wright 1982	65	63.1	18.5		10.8	7.7	26.2
23JA170	Jurney 1982c	38	42.1	26.3	5.3	26.3		44.7
23JA110	Reeder 1978	47	40.4	44.7*			14.9	17.0***
23JA110	Reid 1980b	56	70.0	30.0**				
Early Woodland								
23JA159	Wright 1980	13	69.2	7.7		23.1		13.0
Middle Woodland								
23JA110	Reeder 1978	44	77.3	18.2*		4.5		15.0***
23JA238	Schmits:this volume	9	66.7		22.2		11.1	11.1
Late Woodland								
23JA238	Schmits:this volume	6	66.7				33.3	33.3
23JA85	Brown 1981b	14	71.4	21.4		7.1		NA
Mississippian (May Brook Phase)								
23JA43	Schmits 1982b	16	62.5				37.5	31.3
23JA238	Schmits:this volume	4	75.0				25.0	0
23JA115	Brown 1981a	40	75.0	12.5			12.5	NA

*Total includes combined Argentine and Westerville cherts
** Total includes Westerville and Spring Hill cherts
***Data available is for entire biface assemblage
NA=Information not available

The information regarding the use of heat-treatment (Table 60) indicates a lack of thermal pretreatment of chert at the early Middle Archaic Blue Springs phase component at 23JA143. Considerable use of heat treatment is evidenced at the late Middle Archaic Jacomo phase component at 23JA155, as well as at the Late Archaic Nebo Hill phase sites. A high percentage of the point assemblage from the early Late Woodland Woods Chapel phase component at 23JA238 is heated, as is the May Brook phase component at 23JA43. The use of heat treatment in lithic technology therefore appears to have been important from the late Middle Archaic period through the Mississippian periods.

SUMMARY

In summary, work along the Little Blue drainage has provided evidence of human occupation extending from the Paleo-Indian through the late prehistoric Mississippian period. The Paleo-Indian, Dalton and Early Archaic periods are represented by the occasional recovery of early points, such as Plainview, Dalton and Graham Cave side-notched, principally on upland sites. Middle Archaic sites have been located buried in terrace fills and on upland settings. At least two separate Middle Archaic complexes are represented. The early Middle Archaic Blue Springs phase, represented by 23JA143 and the Coffin site (23JA200), is characterized by small side-notched points and appears to be related to other early Middle Archaic complexes in the eastern Plains. The late Middle Archaic Jacomo phase occupation at the Cold Clay site and 23JA277 is characterized by larger corner-notched and expanding stemmed points. This later phase appears to be more closely related to late Middle Archaic complexes to the east in Missouri and Illinois.

Radiocarbon dates from the Late Archaic Nebo Hill phase sites in the Little Blue valley range from 4550 to 2970 years B.P. The Nebo Hill phase is represented by a number of large upland sites, such as Turner-Casey and 23JA170, and smaller lowland sites, such as Sohn. These sites are characterized by lanceolate points with biconvex cross-sections, bifacial hoes and fiber-tempered ceramics.

The Early Woodland period extends from approximately 2000-2500 years B.P. and is characterized by a number of small Bowlin phase sites located on the T-1 terrace of the Little Blue River. The most extensively investigated Early Woodland site is the Traff site, which is characterized by an artifact assemblage including subtriangular corner-notched points and a smaller number of contracting stemmed Langtry points.

Middle Woodland sites in the Little Blue valley appear to largely represent a continuation of the local Early Woodland tradition along with a representation of Middle Woodland Kansas City Hopewell sites. Radiocarbon dates from these sites range from 2220$\pm$195 to 1355$\pm$210 years B.P., but appear to cluster within a more restricted interval from approximately 2000-1600 B.P. The most intensively investigated Middle Woodland sites are the Black Belly and Sohn sites.

While a number of Late Woodland sites are present in the Little Blue valley, only Sperry (23JA85) and Black Belly (23JA238) have produced substantive information. The early Late Woodland Woods Chapel phase component at Black Belly is characterized by plain surfaced sand tempered ceramics, which occasionally have crenated lips, and Steuben points. Ceramics from the later Lake City phase occupation at Sperry are distinguished by a higher percentage of cordmarked sherds and by a predominance of grit temper. Projectile points consist of small arrow points similar to the Scallorn type.

Mississippian period occupation of the area is marked by the local May Brook phase, which is related to the Plains Village populations to the west. The most intensively investigated sites are the May Brook and Seven Acre sites. Relatively little evidence of Mississippian Steed-Kisker occupation of the Little Blue valley has been encountered.

The cultural sequence outlined for the Little Blue valley indicates intensive occupation of this region from the Middle Archaic period ca. 7000 B.P.) to the Mississippian period (ca. 600 years B.P.). Through time, settlement types included residential extractive camps and short term extractive loci. Evidence of more permanent base locales is present for the Late Archaic and possibly early Late Woodland periods. The pattern which seems to have persisted from Archaic through Mississippian times is principally one of seasonal occupation by relatively small dispersed groups. These groups made extensive usage of valley bottom locations with only the Late Archaic Nebo Hill phase showing a reversal of this preference for lowland site locations. Throughout this period, subsistence was primarily focused on hunting and gathering of resources from oak-hickory forest and prairie-woodland edge environments. The principal focus of these efforts included protein-rich deer and mast products supplemented by herbaceous plant resources. Riverine resources (e.g., fish) and tropical cultigens were utilized only to a limited extent.

Lithic technology remained fairly stable throughout most of the known prehistoric sequence. The dominant bifacial tools include projectile points and a smaller number of other bifacial tools. Other tools primarily consist of utilized and unifacially retouched flakes. This technology persisted from Middle Archaic through Middle Woodland times. At about A.D. 900, small corner-notched points, probably arrow points, replaced these larger forms. However, this technological shift does not seem to have had a great impact on hunting strategies. Ceramics make their earliest appearance at Late Archaic sites, however, they are infrequently found in Late Archaic or Early Woodland contexts. They are more common at Middle Woodland, Late Woodland and Mississippian period sites, although only small numbers are found at most of these later sites.

Resource availability in the Little Blue valley is diverse and abundant but susceptible to minor climatic changes. In general, the variety of edge-environments offered by the mixed prairie forest environment contained the necessary supplies of food. Subsistence was probably influenced by yearly fluctuations in the distribution of suitable stands of mast products and associated fauna. Therefore,

adequate supplies of nutritionally important foods would have been assured by a relatively high degree of mobility during the Middle Archaic period and by more logistically oriented adaptations since that period. Lithic resources were also abundant primarily in the form of local Winterset cherts available within a short distance of the Little Blue valley. Winterset chert was most extensively utilized because of its quality and accessibility although Westerville and Argentine cherts were accessible in nearby locales.

While subsistence related data indicates the maintenance of a hunter-gatherer based economy based on the woodland and prairie-forest edge communities, variability is present in the strategy used to exploit the food resources as shown by the form and location of settlement types. The most persistent settlement type consists of seasonally occupied lowland residential extractive camps. Middle Archaic, Woodland and Mississippian period settlements of this type are present along the Little Blue Valley. A major exception to this is the Late Archaic upland base camps such as Turner Casey and 23JA170. Another possible exception is the early Late Woodland component at Black Belly which also appears to be a base locale.

The maintenance of a hunting-gathering subsistence base over a long period of time probably had its greatest effects on the social organization of the area's inhabitants. As discussed above, the advantages of mobility, population dispersal and aggregation and site differentiation were probably instrumental in assuring adequate subsistence without relying on food production, such as horticulture or agriculture. The processes of implementation of the different settlement types necessitated a degree of flexibility within various levels of group interaction. For example, the seasonally dispersed-aggregated pattern suggested for the Late Archaic would have required that the structure of the smaller group be compatible with that of the seasonal gathering of several such groups.

The settlement patterns for the subsequent Woodland and Mississippian periods in the Little Blue valley appear to consist of seasonally occupied lowland settlements established by smaller groups. The absence of larger permanent villages or base camps indicates the disappearance of more structured organization and the continuance of a long established set of traditions regarding group interaction. These forms of hunter-gatherer cultural adaptations in the Little Blue valley imply that its existence was predicated on relatively flexible settlement policies and social relationships. Thus, it is difficult to imagine at any time the presence of a level of social organization more complex than the band level.

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APPENDIX I

GLOSSARY OF TECHNICAL TERMS

abscission - A separation.

adiabatic colling or warming - Changes in air temperature that are caused by changes in air pressure.

alluvium - Soils, sands or gravels deposited by the slowing of running water, such as those released when a stream floods

antebrachium - Part of forelimb between upper arm (brachium, or humerus) and wrist (carpus).

anthropology - The study of humans inclusive of their physical and cultural attributes. Traditionally, anthropology includes the subfields of physical and cultural anthropology, linguistics, and archaeology.

archaeology - The scientific discipline responsible for recovering, analyzing, and interpreting the unwritten portion of human kind's historic and prehistoric past.

archaeological assessment - An evaluation of the archaeological resources present in an area, their scientific significance, and the cost of protecting or properly investigating them.

archaeological excavation - The scientifically controlled recovery or salvage of a site designed to yield maximum information about the life of the inhabitants, their ways of solving human problems, and of adjusting to and modifying their natural environment.

archaeological inventory - A pedestrian field survey of a given area. This generally includes a records-check.

archaeological resources - Objects and areas made or modified by humans and the data associated with these artifacts and features.

Archaic - A cultural stage prior to the introduction of pottery and agriculture.

argillic horizon - A strong developed B horizon of a soil that has at least 1.2 times as much clay as the horizon above it. It must also have clay films on ped surfaces.

arrowhead - A small projectile point often less than one inch in length, used to tip an arrowshaft.

artifact - A material object made, modified or used by humans. The most common artifacts on archaeological sites include fragments of broken pottery (sherds), stone tools, chips, projectile points, and similar lithic debris.

assemblage - A major class of artifacts found in an archaeological site such as stone tools, animal bones or botanical remains.

astragalus - A large proximal bone of the tarsus (ankle).

atlas - The first cervical (neck) vertebra.

awl - A bone or stone tool used primarily to perforate leather for sewing or in basket weaving.

axillary - Near the cavity (pit) beneath the brachium.

backed knife - Chipped stone knife with the long edge opposite the cutting edge being intentionally dulled in order to reduce injury to the user.

basal grinding - Dulling the lower lateral edges of a projectile point by abrasion in order to reduce the chance of the sinew binding being cut after the point was seated in the shaft.

bifacial - Deliberate alteration upon two opposite surfaces of a stone tool.

blade - Either the unhafted portion of a projectile point or a long narrow flake, generally with parallel sides.

blank - An unfinished chipped stone tool partially worked to the shape and size of the intended implement.

body sherd - Fragment from the lower portion of a ceramic vessel.

B.P. - Years before the present.

brachium - The upper segment of the forelimb, between shoulder and antebrachium.

buccal - Towards the lips.

burial mound - Mounds, often of rock or rock and earth, locally built primarily during the Woodland period which contain human burials.

buried soil - Soil covered by more recent alluvium, loess, or other deposit.

calcaneum - A large bone of the tarsus (ankle) which in man forms the heel.

cambic horizon - A moderately developed B horizon of a soil with less than 1.2 times as much clay as the overlying horizon. It does not have clay films on ped surfaces.

camp site - An archaeological deposit, usually small and thin, which is the result of a habitational settlement by a group of people.

carpal - One of the bones of the carpus (wrist).

carpometacarpus - The fused distal carpal and metacarpal bones of birds.

chert - A structureless form of silica, closely related to flint which was used for chipped stone implements.

chipped stone tools - Knives, scrapers, projectile points, and other artifacts produced by removing flakes from sileceous rocks.

chroma - A measure of the strength of spectral color.

chronology - The study of a culture or site in terms of its age. The orderly sequence of a series of sites or cultures according to their occurrence in time.

clay - A soil separate consisting of particles 0.002 mm in equivalent diameter. Soil material containing more than 40 percent clay, less than 45 percent sand and less than 40 percent silt.

colluvium - A deposit of rock fragments and soil material accumulated at the base of steep slopes as a result of gravitational action.

complex - A series of assemblages or of components which might be defined as a focus (phase), but where there is enough uncertainty as to their associations to refrain from so grouping them.

component - The manifestation of any given focus (phase) at a specific site. The social equivalent of component is the community.

condyle - A rounded process on a bone, usually in pairs, as those on the distal ends of femur and humerus.

core - Nodule of stone from which flakes are removed. Typically a core is reduced until most usable flakes are obtained and then it is discarded.

cortex - The outer surface or rind of a chert nodule.

cubonavicular - A bone in the distal row of the tarsus (ankle) formed by the fusion of cuboid and navicular bones.

cultural resources - Districts, sites, structures, and objects and evidence of some importance to a culture. These resources and relevant environmental data are important for describing and reconstructing past lifeways, for interpreting human behavior, and for predicting future courses of cultural development.

cultural resource management - The development and maintenance of programs designed to protect, preserve and scientifically study and manage cultural resources.

curation - The systematic maintenance and storage of the archaeological data base in such a manner as to retain the integrity of those data and allow it to be accessible and usable for future researchers.

daub - Mud or similar substance used as a plaster to seal cracks and crevices in a dwelling of frame poles interwoven with twigs. This construction technique is called wattle and daub.

debitage - Residual lithic material resulting from tool manufacture.

determination of eligibility - The determination that a property is eligible for inclusion in the National Register of Historic Places. The determination process, outlined in 36 CFR 63, provides the mechanism whereby a government agency can determine whether its undertaking affects significant properties, as required by P.L. 93-291, Section 3 (a) or (b), for those properties not already on the National Register.

diagnostic artifact - Artifacts which have a specific association with particular cultures. Often these are highly formalized tools such as ceramics or projectile points.

diaphysis - Shaft of a long bone.

diastema - An edentulate portion of a mandible or maxilla.

drill - A chipped stone tool with a beveled, pointed end used as a drill or perforator.

edentulate - Without teeth.

entepicondylar - The area above (epi-) the inner (ent-) condyle.

environment - The physical character of the area in which a culture occurs, including its flora, fauna, climate and land features.

epicondyle - The area above the condyle.

erosion - The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

exfoliation - The peeling of layers.

facet - A smooth flat circumscribed surface usually present on an articular surface.

feature - Usually a specific structure at archaeological sites such as fire pits, storage pits, burial pits, or post holes.

fibula - The outer and smaller of the two bones below the knee.

flake - A thin, flat piece of lithic raw material usually chert removed from a stone cobble or core by flaking.

flake tools - Stone tools made from flakes removed from cores.

floodplain - The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

fluted - Term which refers to a stone tool manufacturing technique associated with the Paleo-Indian period and which consists of relatively long parallel-sided scars on tool surfaces.

foramen - A small opening.

fossa - A depression.

frontopariental suture - A line along which the frontal and parietal bones meet on the skull roof.

gallinaceous - Chicken-like.

geomorphic - Relating to the form of the earth or its surface features.

gouge - A chisel with a scoop-shaped cutting edge to be used in woodworking.

graver - A small or cutting tool with a sharp point or edge used for boneworking.

granular structure - Soil structure in which the individual grains are grouped into spherical aggregates with indistinct sides. Highly porous granules are commonly called crumbs.

grit tempering - Crushed particles of rock such as limestone or granite which are added intentionally to pottery clay. The grit tempering keeps the pottery vessel from breaking when it is fired.

grog - Previously fired clay sherds ground and used as a temper in making new ceramic vessels.

ground stone - Tools manufactured by pecking and abrading various rock types such as granite, quartzite or greenstone. Usually included in this category are grinding and pounding implements such as the manos, metates, mortars, and pestles, as well as celts and axes.

haft element - The portion of a tool exhibiting some modification such as notching, constriction and or grinding) allowing it to be fastened to a handle or shaft.

hammerstone - A cobble-sized stone often a river cobble used as a hammer and characterized by a battered end.

horizon, soil - A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:

O Horizon. An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A Horizon. The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B Horizon.

Ap Horizon. The surface layer of a soil disturbed by cultivation or grazing.

B Horizon. The mineral horizon below an A horizon. The B Horizon is in part a layer of transition from the overlying A Horizon to the underlying C Horizon. The B Horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A Horizon; or (4) a combination of these. The combined A and B Horizons are generally called the solum, or true soil. If a soil does not have a B Horizon, the A Horizon alone is the solum.

C Horizon. The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B Horizons. The material of a C Horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R Layer. Consolidated rock beneath the soil. The rock commonly underlies a C Horizon, but can be directly below an A or B Horizon.

indurated clay - Temper inclusions in ceramic paste made from ground shale.

in situ - A Latin phrase meaning "in place". An artifact or object found in its original, undisturbed position. Items found in situ provide an opportunity for establishing firm stratigraphic or other associations for dating purposes.

incised - A design cut into a pottery surface.

integrity - A site that is intact and undisturbed enough to permit the preservation of significant scientific data possesses integrity.

intensive survey - Systematic, detailed, on-the-ground field inspection conducted by professional archaeologists which is sufficient to permit determination of the number and extent of the resources present and their scientific importance.

intrusive - An archaeological object occurring out of its proper cultural and chronological context.

knapping - The act of flaking stone tool artifacts.

lanceolate - Shaped like a lance, being tapered at one or both ends. The term usually refers to long slender chipped stone points or knives pointed at one end.

lingual - Towards the tongue.

lithic - Referring to stone.

lithic scatter - A site characterized by a number of flakes and tools.

loam - The textural class name for soil having a moderate amount of sand, silt, and clay. Loam soils contain 7 to 27 percent of clay, 28 to 50 percent of silt, and less than 52 percent of sand.

loess - Material transported and deposited by wind and consisting of predominantly silt-sized particles.

mano - A hand stone that has been shaped for use as a grinding or mealing stone in connection with a metate. It is used for crushing and grinding vegetable matter.

manus - The forefoot.

metapodial - Either a metacarpal or a metatarsal.

metacarpal - One of the long bones separating the carpus (wrist) and phalanges (digital bones).

metatarsal - One of the long bones separating the tarsus (ankle) and phalanges (digital bones).

metate - A flat stone upon which seeds and other foods are mashed and ground. A hand stone or mano is used with it.

midden - A trash or refuse deposit.

mitigation - The amelioration of losses of significant scientific, prehistorical, or archaeological data accomplished through pre-planned actions to preserve or recover such data by application of professional techniques and procedures.

National Register, the - An official list maintained by the National Park Service of architectural, historical, archaeological, and cultural sites of local, state, or national significance worthy of preservation. These sites are nominated to the Register by states or federal agencies and are approved by the National Register staff of the National Park Service.

ocher - A crushed ferruginous (iron rich) mineral ranging from yellow to brown, used as a pigment. Red ocher (hematite) is very often used for ceremonial purposes.

os coxae - One half of an entire pelvis, consisting of three bones (ilium, ischium, and pubis) which meet at a pit (acetabulum) for the femur head.

palynology - The scientific study of pollen.

patella - The kneecap.

ped - A unit of soil structure such as an aggregate, crumb, prism, block, or granule, formed by natural processes (in contrast with a clod, which is formed artificially).

peds - Soil aggregates with naturally preserved boundaries.

percussion, direct - A knapping technique in which the flaking tool such as a hammerstone or antler baton is struck on the core or partially finished tool.

percussion, indirect - A knapping technique in which the flaking tool is struck on an intermediate tool (punch) which in turn strikes the core or partially-finished tool.

perforator - A chipped stone artifact used as an awl or punch.

peroneal - Near the fibula.

pes - The hindfoot.

petrous temporal - A hard and dense part of the temporal bone that houses the inner ear organs.

phalanges - The digital bones beyound the metacarpus or metatarsus.

pisiform - A bone on the ulnar side of the carpus (wrist).

phase - The manifestation of a basic cultural unit that could be comparable to social units in ethnography, such as a tribe or interrelated bands or any unit that has relatively definite boundaries spatially and chronologically and is relatively uniform culturally.

plano convex - Having one flat and one convex side in cross-section.

platy - Consisting of soil aggregates that are developed predominately along the horizontal axes that are laminated and flaky.

Pleistocene - The earlier epoch of the Quaternary characterized by recurrent ice ages.

point - A bifacially flaked symmetrical chipped stone artifact exhibiting a point of juncture on one end and some facility for hafting on the opposite end.

pollical - Relating to the first digit of the forelimb (thumb).

post mold - A stain in the soil representing a house post resulting from a wooden post that has rotted away. It is identifiable by the darker color than the surrounding soil matrix.

pot sherd - A piece of a broken pottery vessel.

pottery - A mixture of clay and a tempering agent which is hardened by firing.

preform - A chipped stone tool that has been modified to a near complete stage in a lithic reduction sequence. It is not a finished implement but has the general form of the intended tool.

prehistoric - Prior to written records.

pressure flaking - A method of chipped stone manufacture in which the knapper puts the tip of the flaking tool (e.g., antler tine) on the edge of the nearly-finished stone tool and then "pushes" off each flake. Pressure flaking is generally the final stage in the making of a stone implement.

primary flake - One of the initial flakes detached from the outside of a core. A portion of the core's weathered exterior (cortex) is retained on the flake.

principal investigator - A professional archaeologist and the person directly responsible for the archaeological project.

process - A part of a bone that projects away from the main mass.

projectile point - A bifacially-flaked implement with a pointed distal end and a proximal end designed for attachment to a shaft (Generally used as a spear point, dart point or arrowpoint).

Protohistoric - The time immediately preceding the beginning of written history in an area. Often European trade goods occur on Protohistoric sites.

provenience - The exact horizontal and vertical location of an artifact or other remains within a site.

quarry site - A location where aboriginal knappers obtained the raw material to make their tools. Much of the lithic reduction of large nodules was often done at the quarry in order to avoid transporting unnecessary weight back to camp.

quartzite - A compact, granular rock composed of quartz, often used for ground stone implements.

radiocarbon dating - A method of obtaining the date of bone, shell, or other organic items by measuring the amount of radioactivity of Carbon 14 in them.

reconnaissance survey - A literature search and records review and a preliminary on-the-ground surface examination of a limited portions of an area to be affected. This type of survey is generally adequate to assess the general nature of cultural resources probably present and the likely impact of a project.

research design - A plan, usually generated by the principal investigator outlining the proposed approach to an archaeological investigation. The research design spells out relevant research problems, research methods and some predicted results of the study.

retouch - Secondary flaking of a stone implement to remove surface irregularities and to refine or modify the cutting edge. Always done by pressure flaking.

rim sherd - A fragment of the upper circular edge of a ceramic vessel.

rock shelter - An overhang, usually along the base of a cliff or escarpment in which occupation by humans has taken place.

sand - A soil particle between 0.05 and 2.0 mm in diameter.

scope-of-work - A document prepared by a sponsoring agency setting forth its requirements in a cultural resources study.

scraper - A stone implement usually used to remove fat from hides, but sometimes to smooth wood. Different types are described in terms of the shape and position of the scraping edge such as: side scraper, end scraper, etc.

sediment - Deposit of mineral particles, usually clay, silt or sand.

sedimentation - The natural process of soil accumulation derived from alluvial (riverine) or colluvial (mass earth movement) processes.

serrated - Having a saw-toothed or multiple-notched cutting edge.

sesamoid - A pea-shaped bone developed in tendons.

settlement pattern - Distribution of various sites of human activity in a locality (village sites, quarry sites, kill sites, ceremonial sites, etc.).

shatter - Irregular pieces of lithic manufacturing debris.

shell tempering - Small pieces of crushed shell added to the clay before making pottery. Common in the Mississippian or Plains Village period sites.

sherd - A broken piece of a pottery vessel.

silt - A soil textural class consisting of particles between 0.05 and 0.002 mm in equivalent diameter.

site - Any area or location occupied as a residence or utilized for sufficient time to leave an archaeological record. Can be a camp village or quarry.

soil - A dynamic natural body on the surface of the earth in which plants grow, composed of mineral and organic materials and living forms. The collection of natural bodies occupying parts of the earth's surface that support plants and that have properties due to the integrated effect of climate and living matter acting upon parent material, as conditioned by relief, over periods of time.

soil map - A map showing the distribution of soil types or other soil mapping units in relation to the prominent physical and cultural features of the earth's surface.

soil profile - Composite distinctive layers and zones of a soil, from the surface to the parent material.

solum - The altered layer of soil above the parent material that includes the A and B Horizons.

spokeshave - A specialized type of scraper with a rounded notch in the edge and probably used for scraping wooden shafts.

strata - Natural or cultural layers in the soil or archaeological sites produced by the accumulation of soil and/or refuse deposits.

stratigraphy - The superimposition of geological or archaeological deposits one upon the other. The relationships indicated by stratigraphy provide a relative system of dating archaeological materials and are therefore extremely important in establishing cultural sequences in an area.

stratum - Single sedimentary or cultural layer.

sulci - Shallow grooves.

sustentaculum tali - A shell-like projection of the calcaneum that is grooved for support of the tendon that flexes digit I.

tarsal - One of the bones of the ankle (tarsus).

temper - Any substance, such as crushed shell, grog, crushed grit or sand added to pottery clay in order to prevent cracking when the vessel is fired.

terrace - A level usually narrow geomorphic surface bordering a stream.

testing - A scientific technique of investigating archaeological sites consisting of the excavation of a small portions of the site to determine the nature and significance of the site.

tradition - The socially transmitted cultural form that persists in time (e.g., an artifact tradition, a religious tradition, local cultural tradition, regional cultural tradition, technological tradition, or a major cultural tradition).

transverse fracture - A break in an artifact, parallel or approximately parallel to the base.

trochlea - A pulley-like structure.

tuberosity - A large and usually rough prominance on a bone which usually serves for the attachment of ligaments or muscles.

Typic Argiaquoll - Mollisols with characteristics of wetness and the presence of an argillic horizon.

typology - The classification of similar artifacts into groups.

unifacial - Deliberate alteration on one surface or edge of a stone tool.

utilized flake - A flake showing evidence of retouch or wear on one or more edges.

vandal - Individual who deliberately destroys or damages archaeological sites.

ware - Pottery or ceramic vessels made from fired clay.

wattle and daub - A technique of house construction involving a framework of poles and interwoven branches which are plastered with clay.